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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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That "Neutral" Point.

Mr. H. P. Parrock has contributed to the "Iron Age" an article entitled "'Neutral Point' in Plant Operation," which bears a sub-heading "Study of Cost Analyses to Determine When to Take Business and When to Let Someone Else Lose Money on it." He has introduced some charts which show at a glance the danger points, a figure which indicates the lowest selling price of castings which can be economically quoted. Whilst these are of considerable interest we feel that such a study is liable to eliminate half the fun from business life and to convert everybody to shop keeping. There is a distinct misstatement in the sub-title quoted above, as it assumes that all foundries have parallel overhead charges. Most foundrymen have heard it said of some small jobbing shop that the foreman ought easily to make it pay, as there is only £15 a week general expenses to be met. Therefore it cannot truthfully be said that a job which is unremunerative to a large concern is also a money loser for a small organisation. It is, however, not merely desirable, but essential, to construct tables or graphs showing how much the interest on buildings, equipment and working capital amounts per lb. of daily output with that figure varying from nothing to full capacity, and allowing 8 per cent. interest and 10 per cent return. Thus, if £10,000 per annum is required to meet all such expenses as a reasonable dividend, directors' fees, bank charges, and depreciation of buildings and plant, when this is divided into progressively increasing outputs it will quickly be realised that at some figure lying between 75 and 25 per cent. output this charge would make the sale of castings prohibitive. A further estimate of the daily expense as affected by output will not result in a straight line curve, because at a certain point a night shift will be required and until this is running to capacity heavier expenses will be incurred. Even before a night shift is necessary, overtime payments may cause serious kinks in the curve.

Obviously, the price at which founders can sell their produce is not governed by internal but external conditions, and whilst every care should be taken to make every order remunerative, we are convinced that every order book will contain certain orders which theoretically of themselves are not economic, but which only entail a minimum of supervision. They allow of general purchases to be on a larger scale and, therefore, perhaps at a lower rate, and they can take iron possibly unsuitable for the balance of the output. If such work can be discarded with complete confidence, it is better to do so, as the establishment of the "neutral" point will clearly show, unless output is very high, when the dictates of common sense indicates the wisdom of their refusal. Here lies the anomaly of the application what may be termed the application of the "neutral" point rule. When the foundry is slack and crying out for orders, that is just the time when only orders carrying a high rate of profit can be taken economically, but during the busy season, castings carrying problematic profit can be undertaken with impunity. This "neutral" point, if known with certainty (which it never is or ever will be), would constitute a nightmare from which in times of depression few foundry owners would recover, but fortunately there are such items in balance-sheets as reserves. Thus the orders taken during busy periods, carrying a high rate of profit, have in reality to "carry" those taken in times of depression with the object of "filling the shop."

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Price of Cast-Iron Pipes.

To the Editor of The Foundry Trade Journal.

Sir,—I read with great satisfaction the letter which appeared in your recent issue from the Managing Director of the Stanton Ironworks Company, Limited, regarding the cast-iron pipe trade.

I would like, on behalf of my own firm, the Staveley Coal & Iron Company, Limited, to publish an equally emphatic disclaimer. We, too, feel that there is a widespread suspicion amongst buyers as to the existence of a Ring, or Association, in the cast-iron pipe trade. As our competitors state, no such organisation is in being in any form. The attitude of the Staveley Coal & Iron Company, Limited, is well known throughout the mining, iron, and chemical industries, as being diametrically opposed to rings or trusts in any guise whatsoever. We are firm believers in the interplay of competitive conditions, both from the standpoint of the national interests, and the healthy development of the fittest of manufacturing concerns. The fact that foreign pipes can be sold at the existing phenomenally low prices is due to obvious economic causes, which are widely known and irremediable.

Yours, etc.,
D. N. Turner,
Managing Director,
Staveley Coal & Iron Company, Limited.

Chesterfield, August 19, 1927.

Book Review.

The Story of Steel. by J. Bernard Walker. Published by Messrs. Harper & Brothers, of 35, Gt. Russell Street, W.C.1. Price 7s. 6d. net.

Although the author admits in the preface that limitations of space prevent any consideration of the subject of tool steel, it can hardly be said that any account of the steel industry, published at the present time, is complete without some reference to special alloy steels. In 1902, when the greater part of this book was written, special steels were practically unknown, but since that time by far the greatest developments in the steel industry have been in this direction, and perhaps it would have been better to have excluded such chapters as those on "The Campaign for Safety" and "Welfare Work" at the expense of including one dealing with these recent and very important developments in the steel industry.

One point which cannot fail to impress the reader of this book is the enormous quantity of materials dealt with by the industry. The figures given are in connection with the steel industry in the United States.

The business of transporting the ore from the mines and its subsequent reduction to pig-iron is very well described. Then follows a description of the Bessemer, electric furnace, and open-hearth furnace processes. With the exception of the electric furnace—which is dismissed in two pages, only one type being mentioned—these chapters give the uninitiated an excellent idea of the way in which these processes are carried out.

The chapters dealing with the production of finished products are very complete for a book of this size, rails, rods, wire, nails structural shapes and pipes, etc., being considered.

The concluding chapters of the book are devoted to the commercial side of the steel industry, and more particularly of the American Steel Corporation.

About forty illustrations are included in the text, but a large number of these have been very badly reproduced, so much so that in some cases it is difficult to distinguish the important features.

Despite these criticisms, however, the layman who wishes to obtain a general idea of the production of steel and steel products should find this book interesting and useful.

Random Shots.

September seems of all months to be the most popular with the organisers of conferences. Indeed, those energetic souls who make a point of never missing any of these events must find themselves rather overworked, particularly when they are obliged to be in two widely separated places at the same time—or at best on consecutive days! Annual meetings announced for this month include the British Association, which meets at Leeds from August 31 to September 7, the Institute of Metals, Derby, September 6 to September 11, the Iron and Steel Institute, Glasgow, September 20, 21 and 22. In addition there is the Shipping, Engineering, and Machinery Exhibition, which takes place in London, at Olympia, from September 8 to 24.

* * *

Looking farther afield, we find the Empire Mining and Metallurgical Congress opening at Toronto at the end of August and lasting throughout September; the International Congress on Testing Materials at Amsterdam from September 12 to 17; the Congress of Scientific Management, already referred to in these pages, at Rome, from September 5; and in connection with the Volta Centenary Exhibition, which has been open all the summer at Como, there will be an International Congress of Physics in commemoration of the same event at Como from September 11 to 17. Further, there is the French Foundry Exhibition and Convention in Paris. . . . A fairly formidable list, especially when we remember that there will probably be just as many meetings going on at the same time concerned with subjects that are outside the field of our interests—Esperanto, for instance, and Education, and Phonetics, and the Radio Exhibition, and Libraries. . . . It seems that the I.B.F. is to be congratulated on its originality in choosing and abiding by July for its annual gathering; no doubt it reaps the reward in greater attendances and keener interest.

* * *

The much-debated question of Ultra-Violet Ray treatment for mine workers has lately been brought before the public eye. It is shortly to be introduced into certain Nottinghamshire mines, and as a preliminary experiment a number of pit-lads have been taken to Switzerland for a fortnight. The intention is not only an experimental one on the part of the various societies concerned to prove the value of sunlight, but it is also a bid for the interest and support of the workers who will be intimately concerned with the sequel to this trip.

* * *

To a considerable number of founders the prospect of a completely mechanised army must be at least as alarming as it appears to be to the professional cavalryman and horse-breeder. By no means a small part of the equipment and fittings of a cavalry unit begin life in the foundry. But, after all, if the foundryman be intimately concerned with the outfit of a unit of horses, he will be no less intimately concerned with the outfit of a unit of tanks! A change there is bound to be—but it will not necessarily be to our disadvantage.

* * *

A competition was recently held to stimulate the efficiency of the page-boys in our big London hotels. May we humbly suggest that there are other fields where a similar experiment might not come amiss? Why not, for instance, a competition among taxi-drivers, the points at issue being courtesy, modesty with regard to tips, and engine efficiency? Or waiters—or porters—or ticket-clerks—or—stay, why not telephone girls? We feel that in this case every wrong number given during the day should count for one bad mark, while there might be special credit for variations on such familiar formulæ as "Sorry you've been tr-r-r-rroubled!"

* * *

A barrister recently remarked that the turf refuses to grow on some golf courses on account of the bad language used by members. Now, at last, we appreciate why vegetation is so conspicuous by its absence in the immediate vicinity of foundries.

Marksman.

Cast Chaplets and Tinned and Untinned Core Irons.*

By Jacques Varlet, Seraing, Belgium.†

Coated and Uncoated Steel Studs.

In order to determine the difference between bars coated with tin and mild-steel bars—which in cored castings for wedging and supporting the cores, either of small or large dimensions, the following experiments were made:—

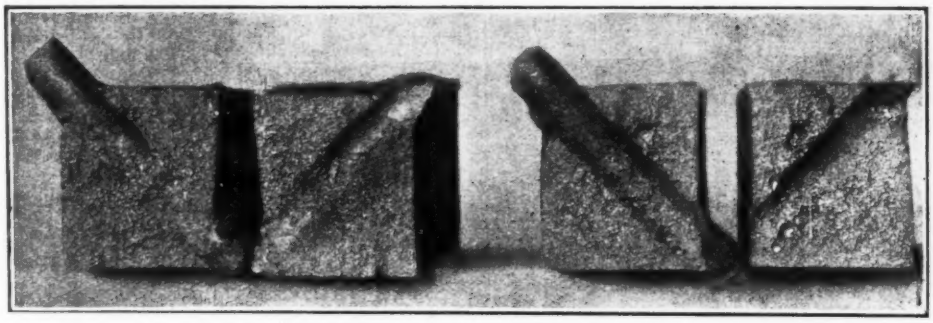

FIG. 1.—TEST MOULD—UNTINNED CORE IRONS.

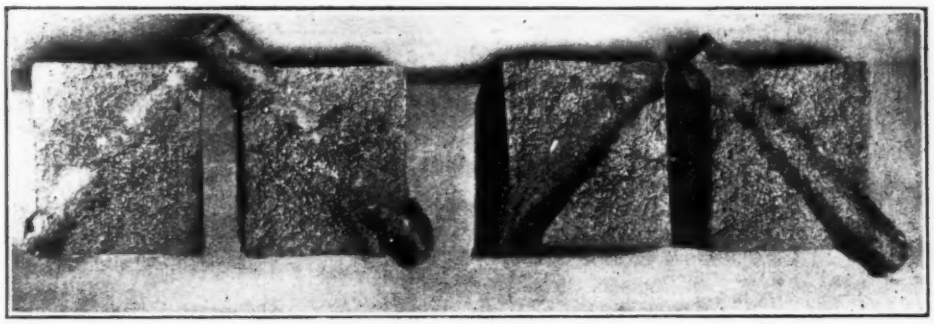

FIG. 2.—TEST MOULD—TINNED CORE IRONS.

FIG. 3.—TEST MOULD—UNTINNED CORE IRONS.

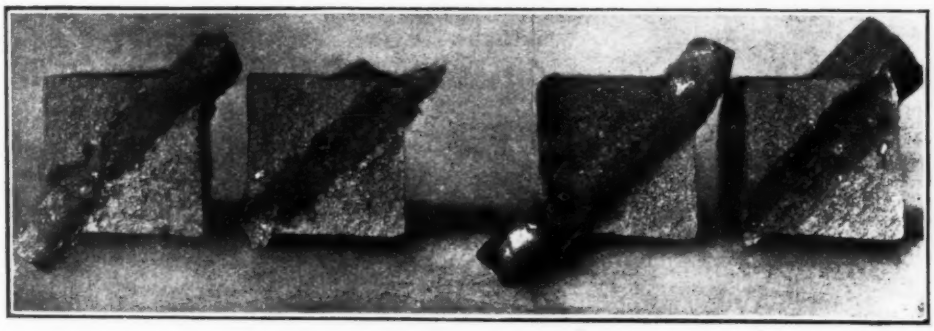

FIG. 4.—TEST MOULD—TINNED CORE IRONS.

may be considered as representing in use either double chaplets or bar chaplets such as are used

(1) Bars 12 mm. dia. (0.472 in.) coated with tin and similar untinned bars were placed in square test moulds 50 by 50 and 40 by 40 by 200 mm. (1.969 by 1.969 and 1.575 by 1.575 by 7.87 in.).

(2) The moulds were made for top pouring in the case of Figs. 1, 2, 3 and 4.

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* Exchange Paper of the Association Technique de Fonderie de Belgique.

† Vice-President, Association Technique de Fonderie de Belgique.

(3) The test pieces at the left-hand side in each figure represent the bars placed in the moulds into which a volume of an iron suitable for engineering purposes representing a weight of 70 kg. (154 lbs.) was poured for one minute by

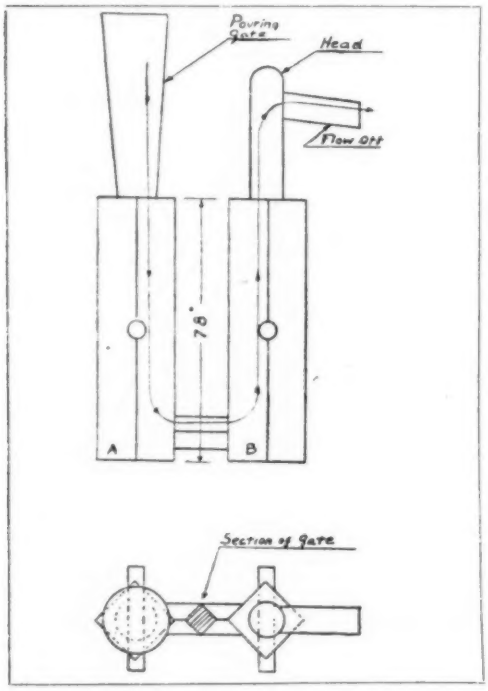

FIG. 5.—SHOWING METHOD OF POURING TEST MOULDS OF FIGS. 1 TO 4, INCLUSIVE.

means of small hand ladles, the mould being kept continuously filled.

(4) The test pieces at the right-hand side formed part of the same flask, and were connected to its fellow by a bottom gate. They were therefore subjected to the same operation and received the same quantity of metal, but by bottom pouring. Fig. 5 shows how these test pieces were made.

Figs. 1 and 3 are those in which the bars were untinned, while Figs. 2 and 4 represent those of the irons coated with tin.

Numerous tests, made with the greatest care, showed that the tinned iron welds badly and produces a large number of blisters at the junction of the iron with the tinned part, as may be seen from Figs. 2 and 4.

The test pieces which were cast by top pouring were not so good as those which were bottom poured in accordance with the diagram of Fig. 5. This test shows that by top pouring, notwithstanding all the precautions taken to keep the pouring gate and the mould continuously filled during casting, air is nevertheless drawn into the mould and oxidation thus takes place on contact with the iron. With all the precautions taken to prevent the admission of air into the moulds, and particularly when the pouring period is fairly long, it would nevertheless appear that the first entries of air are completely evacuated in 10 to 15 seconds. But the same defect is reproduced at each test, whereas it is not produced by bottom pouring except on the test piece shown in Fig. 1, where it is insignificant in comparison with the tinned and untinned irons obtained by direct pouring.

The analyses of the irons are given in Table I.

TABLE I.

	Before pouring.		After pouring.	
	Tinned iron.	Untinned iron.	Tinned iron.	Untinned iron.
C ..	0.070	0.080	0.070	0.080
Si ..	0.085	0.005	0.141	0.141
Mn ..	0.428	0.428	0.370	0.340
S ..	0.032	0.040	0.064	0.048
P ..	0.095	0.080	0.243	0.220

Macrography.—Fig. 6 represents two top-poured test pieces of Figs. 1 and 2 cut in wedge form so as to show the cross section of the iron. The first is that of the tinned iron and the second that of the untinned iron test pieces. It will be observed that the untinned iron has a better appearance and welds better than the tinned iron.

Conclusions.—From these repeated tests it may be concluded:—

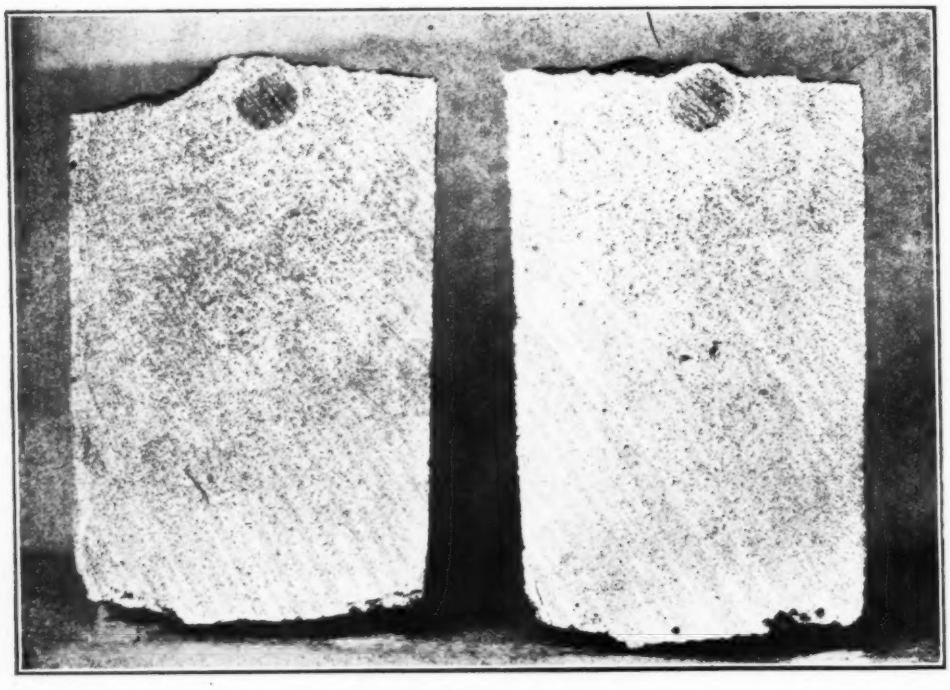

FIG. 6.

(1) That when tinned chaplets, double or with bars, are used, they must be of good manufacture, and that the iron must be pickled before the chaplets are tinned; and (2) that if untinned irons are used as chaplets, particularly in the form of bars, they must be well cleaned and must have

all the scale removed before use. This work should be so carried out that the bars can be placed in the moulds as late as possible.

The tests show a very marked advantage of the polished iron over tinned iron, even with pure tin, for it welds much better and does not produce the blisters to be associated with the use of tinned bars. Iron suitable for engineering purposes was used. Its chemical analysis was Si, 1.80; Mn, 0.6; S, 0.07; and P, 0.3 per cent. It physical properties were:—

Drop Test.—Height of drop, 60 cm. (23.62 in.) with a 12-kg. (26.5 lbs.) tup. This gave the following results after eight blows repeated at intervals of 5 cm. (1.97 in.):—Initial height of drop, 250 mm. (9.84 in.); rupture, 600 mm. (23.62 in.); number of blows, 8; worked developed in kilogrammetres, 40.800 (295,000 ft. lbs.); strength per sq. mm. of section, 3,825 kg. (5,439 lbs. per sq. in.).

These particulars are given in order to show that the metal used in the tests was of high-grade quality.

Cast-Iron Chaplets.

The same tests were repeated on cast chaplets of various forms as shown in Figs. 7 and 8. The cast chaplets (A and B, Fig. 7) were placed in the 40 by 40 by 200-mm. (1.575 by 1.575 by 7.87 in.) test mould.

The test piece was poured horizontally with a volume of metal amounting to 20 kg. (44 lbs.), the metal issuing from the mould by a riser and flowing through the riser until 20 kg. (44 lbs.) of metal had been poured into the test piece. It will be seen that these two chaplets are almost completely welded, particularly 1 of Fig. 7.

The chaplet of the form of 2, Fig. 7, is the type which has frequently been adopted by inexperienced founders and which ought never to be used, for, although it shows a suitable surface at the two ends for supporting the cores, the centre of the chaplet, forming two cones, cracks on the casting being stripped, and the two conical parts may easily become detached from the casting under the influence of shock, vibration or pressure.

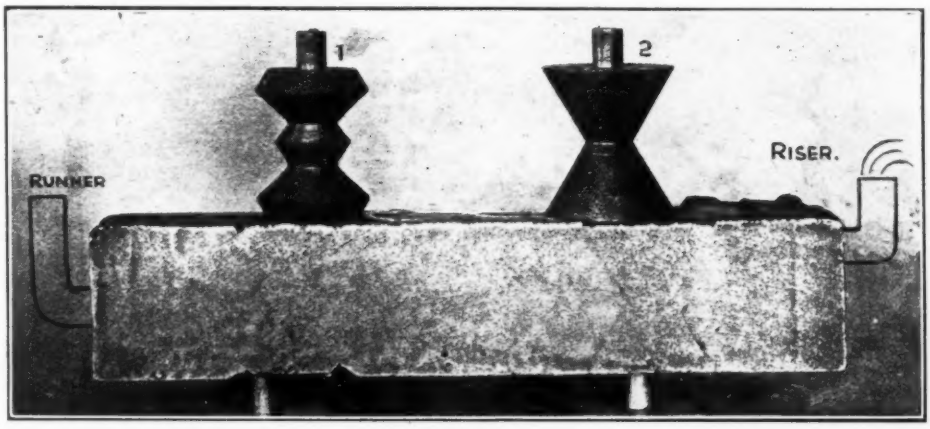

FIG. 7.

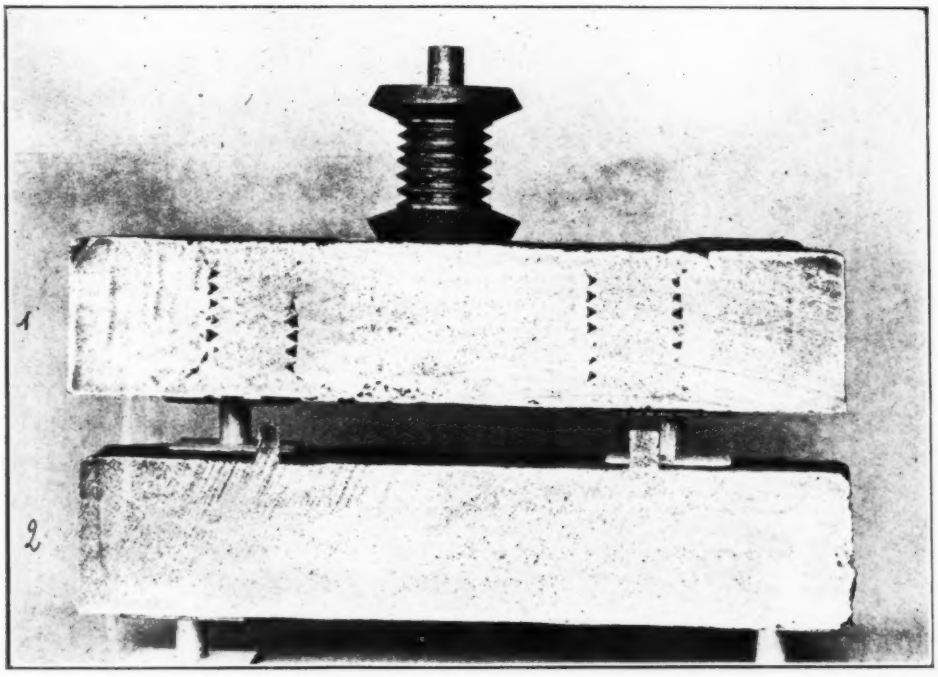

FIG. 8.

While the illustration does not indicate a crack in the centre, by means of a magnifying glass it was possible to detect on the casting some minute cracks caused by contraction, which are the beginnings of complete rupture, whilst chaplet 1 is embedded in the metal with the maximum degree of adherence owing to the six conical parts with which the chaplet is provided.

Fig. 8, test piece 1, was cast similarly to Fig. 7, with straight chaplets of the same metal and of the same weight.

The illustration indicates poor welding between the metal and chaplet. This shape also is not to

be recommended, particularly for light and thin castings. Test piece 2 is top-poured with the same chaplets, and a volume of metal equal to 70 kg. (154 lbs.). It will be noted that it is perfectly welded and that the result is satisfactory.

The test pieces were cast in the same manner with chaplets 1 and 2 of Fig. 7, and the same result was obtained.

It should be specially noted that the numerous chaplets tested were of different metals, their analyses being as follows:—

No.	Si	Mn	S	P
1.	2.56	0.642	0.024	1.63
2.	2.00	0.870	0.040	0.50
3.	1.40	0.700	0.040	0.045

It was found that the No. 1 chaplets welded admirably owing to the very low melting point of the metal and its phosphorus content. No. 2 also behaved fairly well, and was stronger when the thickness was considerable, whilst No. 3 scarcely welded at all owing to the purity of the metal and the high melting point of hematite iron. Table II gives the analyses before and after pouring.

TABLE II.

Analysis of the Chaplets before and after Pouring.

Before Pouring.

No.	Si	Mn	S	P
1	2.00	0.6	0.05	1.4
2	1.75	0.5	0.06	0.5
3	1.40	0.45	0.07	0.045

After Pouring.

No.	Si	Mn	S	P
1	1.87	0.5	0.06	1 07
2	1.75	0.5	0.07	0.55
3	1.40	0.48	0.075	0.15

There was a loss of silicon and phosphorus in No. 1; No. 2 remained approximately the same; whilst No. 3 was affected by the phosphorus of the metal poured.

The analysis of the metal used for pouring round these chaplets was Si 1.7, Mn 0.7, S 0.07, and P 0.95 per cent.

Fig. 9 represents a chaplet used to hold the core of an hydraulic piston, as shown in Fig. 10. The height of pouring head was 4 metres (13.12 ft.). Notwithstanding this height of drop, the chaplets, which were of hematite iron, did not weld, and they were withdrawn from a broken casting, as shown in the illustration.

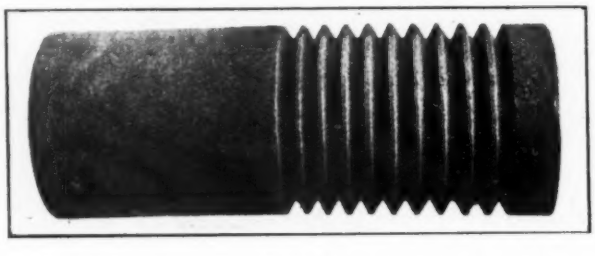

FIG. 9.

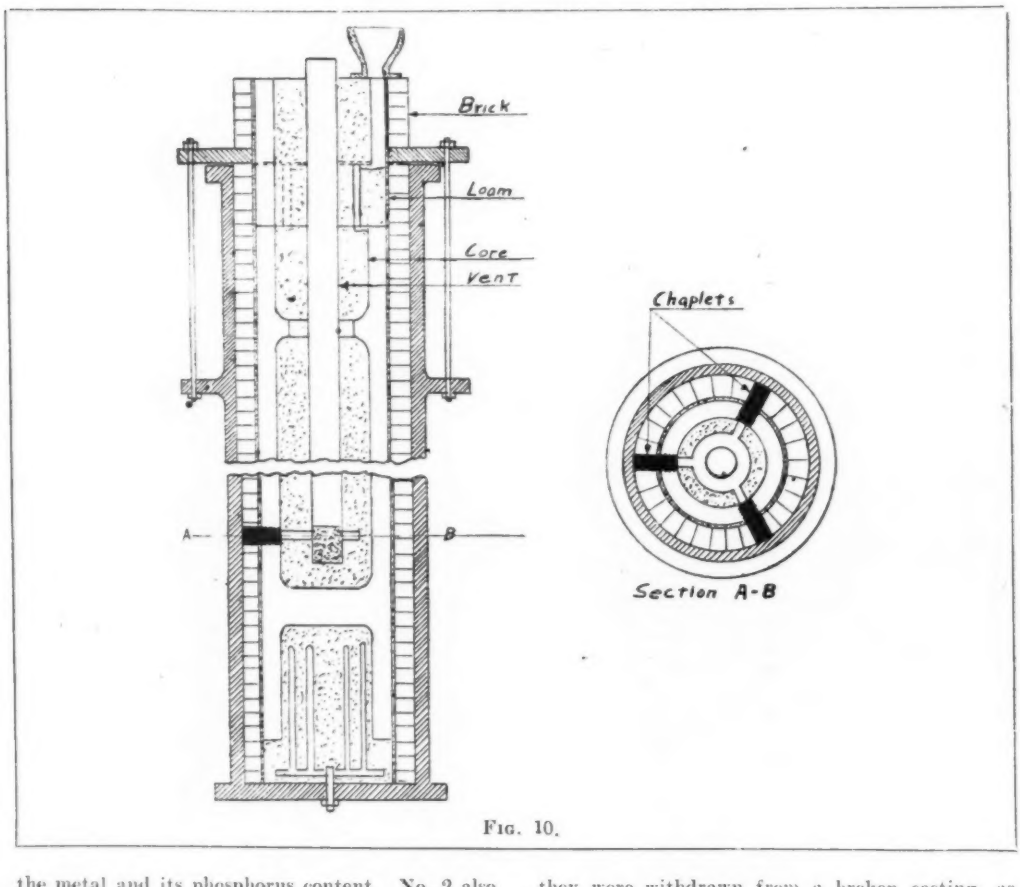

FIG. 10.

Conclusions.

These tests have served to convince the author that cast-iron chaplets must be adapted to the character of the castings—their thickness, the volume of metal to be poured into the mould, the rapid or slow flow of the metal in contact with the chaplets, the volume and weight to be supported, etc. Chaplets of very mild and high phosphorus cast iron, such as No. 1, will not stand the continuous flow of metal very long at a temperature of 1,150 deg. C., for example. They will be com-

pletely melted in a minute and will be of no further use, except in the upper parts of the mould, where the flow of the metal is less constant and of shorter duration.

On the other hand, the chaplets of the analysis of No. 2, being more refractory, soften more slowly and are welded to the casting metal.

The chaplets having the analysis of No. 3 can be used only for castings of great thickness and carrying very heavy cores. In general, however, all the confirming tests show that this metal welds with difficulty, even when the flow of the metal is continuous. It is nevertheless useful, and should be used for certain castings which are subjected to very great stresses.

Generally speaking, the founder must calculate—apart from the character of the metal—the dimensions of the chaplets, for their volume must be proportional to the volume and weight which they have to support, and particularly to the quantity of the metal flowing past them or the volume with which they are surrounded.

One must judge approximately whether, according to their dimensions, they are liable to soften and break or whether they are capable of supporting their load or even welding with the metal without softening too much. It is therefore a question of the volume of the chaplet. A good result will be dependent upon all these factors.

"Spun-Sorbitic" Cast Iron.

Spun-Sorbitic cast iron, as its name indicates, is centrifugally cast and is the product of a new development in the application of the Hurst-Ball centrifugal casting process to the production of cylinder liners, piston valve liners and other similar engine castings. Spun-Sorbitic cast iron is designed to combine the advantages of the centrifugal casting process and low silicon content cast iron, having an "all pearlitic" structure for these purposes.

The general tendency in the application of cast iron to meet the exacting conditions of modern engine design is towards the adoption of lower silicon contents (compatible with machinability) and an all pearlitic structure. Engineers are familiar with many of the developments which

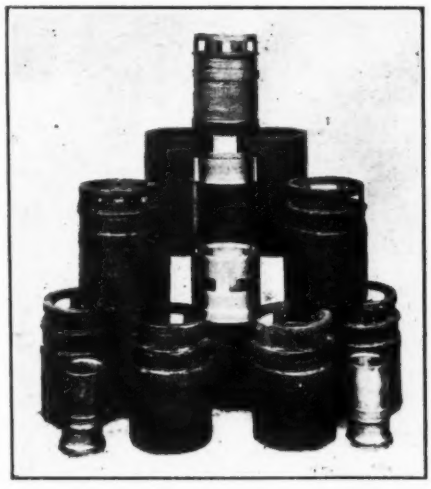

FIG. 1.—GROUP OF SPUN-SORBITIC PISTON VALVE LINERS.

have taken place during the last few years in the production of what has come to be known as pearlitic cast iron.

The advantages of the centrifugal casting process as applied to the production of cylindrical castings is appreciated by all engineers and designers. Several factors, however, have all combined to delay the more extensive development in the application of the centrifugal process to the production of cylinder and piston valve liners. These resolve themselves into two main factors, viz., the difficulty of obtaining the maximum combined carbon in the eutectoid or pearlitic form, together with low silicon contents and the difficulty of producing castings embodying ports and waterway passages variously disposed in the length of the cylinder.

As a result of continued investigation and experiment these difficulties have now been overcome by the Spun-Sorbitic process which been designed by Mr. J. E. Hurst, and is in operation at the Thorncliffe Centrifugal Casting Department of the works of Newton, Chambers & Company, Limited, near Sheffield. By means of this process, for which a patent application has been filed, castings of low silicon material possessing a complete eutectoid structure can be produced, and the difficulties experienced hitherto in embodying ports, waterways, bosses and flanges have been eliminated.

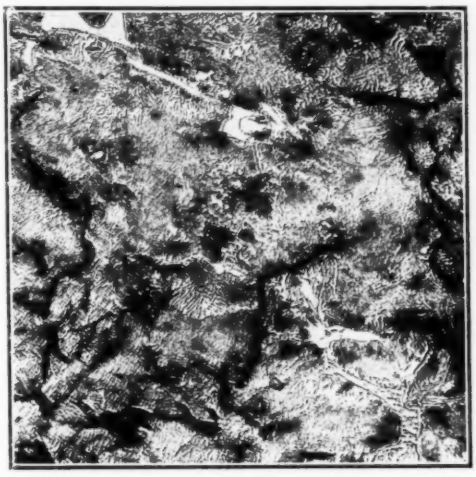

FIG. 2.—REPRESENTATIVE MICROSTRUCTURE OF SPUN-SORBITIC CAST IRON, ×200, ETCHED WITH PICRIC ACID.

A typical example of a group of locomotive piston valve liners cast by this process is illustrated in Fig. 1.

Spun-Sorbitic material combines all the advantages of the centrifugal casting process with pearlitic cast iron, and eliminates the principal disadvantages of pearlitic cast iron produced by certain methods, viz., the large grain size. The Spun-Sorbitic process also goes a step further in that the pearlite constituent is produced in the finely divided or sorbitic form which is well known to be highly resistant to wear. The effect of the centrifugal process in producing cast iron of an exceptionally close grain needs no elaboration here, and it can be readily appreciated that this effect accompanying a material of low silicon content and an "all pearlitic" or sorbitic structure constitutes a distinct advance in the production of cast iron for internal combustion engines and other cylinder liners.

A photomicrograph showing the pearlitic structure of this material is illustrated in Fig. 2, and the chemical composition and mechanical test results obtained from the piston valve liners illustrated above are as follows:—

Total carbon, 3.00 per cent.; graphite, 2.03 per cent.; combined carbon, 0.97 per cent.; silicon, 1.31 per cent.; manganese, 0.42 per cent.; sulphur, 0.11 per cent.; and phosphorus, 0.34 per cent.

The tensile strength is 26.2 tons per sq. in.

It will be specially noted that since it is impossible to cast test bars by the centrifugal process, these test results are of necessity obtained on specimens cut from the castings.

Obituary.

MR. G. W. DAWSON, a director of the Anderson Foundry Company, Port Clarence, has died at the age of 46.

THE DEATH is announced of Councillor C. J. Mawhood, late managing director of Messrs. Markham & Company, Limited, Chesterfield.

THE DEATH OCCURRED on August 21 of Mr. J. Armstrong, who went to the North-Eastern Steelworks 30 years ago as a foreman roll-turner, and by his ability rose to be works manager.

XUM

Blacking Sand Moulds.

By J. Dean, M.I.Brit.F.

Utility of Blacking Mixtures.

In order to strip any part or whole of a casting formed in a body of dry sand, the sand must be blacked when the castings exceed ¼ to ½ in. in thickness. If this is not done, the metal will burn the sand forming the face of the mould and cause a scale or covering on the surface of the casting. This may be ¼ to ½ in. thick on heavy castings. In coating the faces of dried cores or moulds, the greater heat-resisting power the blacking has, the better the casting will strip.

Mixing Blackings.

The mixture may range in consistency from that which will merely discolour up to that of paint. The liquids used for thinning dry blackings may be clear water, clay wash, glue water, and in some cases stale beer. Where the blackings are ground with clay during manufacture, they are rendered suitable for medium or light castings by being wetted with clear water, but for heavy castings this will rarely answer, and clay wash is necessary.

This makes a strong blacking, but it should be used with caution, as an excess of clay in blacking impairs venting. When blacking dries on a mould, forming a close, dense surface, it may cause "blacking scabs" by confining the gases which, in their effort to come to the face of the mould, and passing through the iron, will blow off the coat of blacking.

The difference in the character of dry blackings may be such that a wash working well with one type of casting may not do so with another. When mixing blackings, it is best to bring them to a pasty condition before adding any wash to reduce them to a suitable consistency for application. The finer the blacking is ground, the better mixture it will make; and if the quality of the blacking is good it will not cause foaming or settle as a sediment at the bottom of the mixture, but it will thicken with time. Where the blacking is light and floats on the top of the wash whilst being mixed, it is of an inferior quality, and should not be used on work demanding fine surface; again should a blacking be so heavy as to sink to the bottom in such a manner as to leave the wash separated on the top, it should also be rejected. There is little difficulty in mixing blackings for castings of ordinary thickness, but in massive, heavily-proportioned castings, too much care cannot be exercised. For such work it is a good plan to use fully one-third of plumbago mixed with two-thirds of coal, coke, or a good kind of prepared blacking, and then wet the mixture with water having in it a small quantity of clay.

It is best when possible, to have all blackings mixed a day or two before being used, and in taking them from the barrel or tub in which they have been mixed, to pass them through a sieve before they are applied to the moulds or core. Formerly, every founder had his own secret mixture for making blackings, but now manufacturers are making blackings specially adapted to various thickness and character of castings, and hence there should be no difficulty experienced by founders in obtaining material suitable for work they have in hand and the sands employed.

A New Sprayer Described.

Owing to its being a liquid of thick consistency liable to very quickly and easily separate into its solid and liquid constituents, it had to be swabbed on by hand, or in some cases was applied by a small spraying device adapted to contain only a very small quantity of thin blacking and operated by the user blowing there through with his mouth. This resulted in a considerable length of time being occupied in application of the blacking, particularly to large moulds and in the case of swabbing rendered the moulds readily liable to be damaged or spoiled by carelessness when applying blacking.

These disadvantages have been overcome by an efficient blacking spray that has recently been placed on the market by Messrs. Dean Brothers, of Castle Street, Stockport. This device comprises a container for the blacking provided with a closable filling aperture, and an outlet connected to a spraying nozzle. An air inlet allows a controlled amount of compressed air to enter the spraying nozzle is similarly supplied.

In operation, assuming that the container has been filled by first removing the conical plug, tipping the blacking into the funnel-like part and allowing it to sieve through the sieve into the container, and then replacing the plug to form an air-tight closure, and the blacking to have then been allowed to stand for some time, the solid constituents of the blacking will have settled to the bottom of the container and the liquid constituent or constituents of the blacking will be floating above the solid constituent or constituents: the procedure is as follows:—

The cock on the air supply pipe is closed, the vent is opened and cock on the by-pass pipe is opened. Compressed air that flows from the supply pipe through the by-pass pipe and down the depending pipe and by forcing its way through the blacking in the container displaces the settled constituent or constituents from around the bottom of depending pipe and causes the constituents to be thoroughly mixed in the vicinity of the pipe.

The cock on the by-pass is now closed and the cock on the air supply pipe is opened. Compressed air is then able to flow direct to the nozzle and also into the container through the third opening. By controlling the valve, low, regulatable air pressure is set up in the container to cause the blacking to pass up the depending pipe to the nozzle.

When the blacking reaches the nozzle it fills an annular chamber and oozes through radial passages and fills an annular recess, being thus caught by the stream of air and passing out of the spraying hole with the stream in the form of a spray. Owing to the provision of the annular recess and the consequent small accumulation of blacking mixture therein, the stream of air is prevented from drying the blacking and causing a blocking of the passages. Owing to proximity of the cavity to the spraying hole, the blacking taken by the air stream from the accumulation arrives outside of the nozzle before the air has time to dry it, thus the possibility of clogging of the nozzle is eliminated or reduced. Thus practically the whole of the mixture becomes mixed to a uniform and correct consistency ready for passage up the depending tube as spraying proceeds.

By manipulating the cocks and the valve, all of the pipes can be cleaned out by the compressed air after the work has been finished, any undesirable sediment by settling to the lowest part of the container comes to lie in the sump formed by the cleaning and emptying opening, and therefore does not interfere with action of the device. It can be removed by screwing off the cap covering the opening, whereupon the interior of the container can be cleaned out if desired, for example, by sluicing or rinsing with water. The apparatus is known as "The Jimmy" foundry wet blacking spray.

Personal.

Sir Samuel Roberts, Bart., J.P., P.C., has been elected to the board of Newton, Chambers & Company, Limited, of Thorncliffe Iron Works. Sir Samuel Roberts is also a director of Cammell Laird & Company, Limited, Wombwell Main Company, Limited, and chairman of Wright, Bindley & Gell, Limited.

Wills.

Legg, G. A. T., of Elmswood, Penn Road, Wolverhampton, managing director of Edwin Lewis & Sons, tube manufacturers £6,098

Wimble, A. S., of Sydenham Terrace, Whitley Bay, Northumberland, general manager of the North Eastern Marine Engineering Company, Wallsend £5,940

Morrison, Alexander Findlay, of Talbot Road, Old Trafford, Manchester, founder and managing director of Morrison, Ingram & Company, Limited, sanitary engineers £15,743

Air-Furnace Practice.

By Christian Kluijtmans, B.Sc., M.A.T.F.

The author, having had charge for several years of a 15-ton hand-fired air furnace, as chemist and metallurgist, proposes to give in the following article complete information regarding the composition of the charge and the melting practice of such a plant. To produce malleable iron, either by the European or American process, one must start with white iron castings, which later undergo a thermal treatment called "annealing." For the European process the iron is melted in the cupola, while in American practice the whole of the iron is tapped from the air furnace.

These two processes demand different analyses and mechanical properties. European malleable iron has a steely fracture and an ultimate stress of about 18 to 20 tons per sq. in., the elongation being round about 5 per cent., whilst American blackheart malleable has a grey silky fracture, a tensile stress of between 20 and 23 tons per sq. in., with an elongation ranging from 10 to 18 per cent. in the best material.

Whilst it should not be presumed that blackheart malleable cannot be made by means of the cupola, it can be stated that the product obtained is not homogeneous when examined in the light of numerous different heats, and the writer knows of only two foundries which are getting constant results by this means.

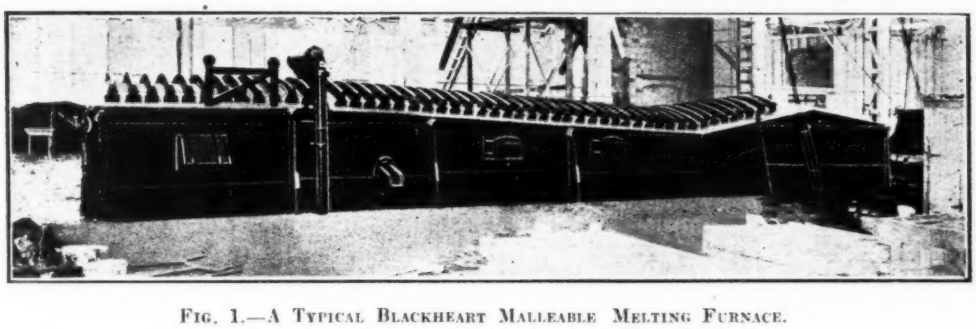

FIG. 1.—A TYPICAL BLACKHEART MALLEABLE MELTING FURNACE.

Air-Furnace Design.

The designing of an air furnace is an easy matter if all the factors bearing upon the melting of the iron are appreciated. It must not be forgotten that the iron must be tapped to time, sufficiently hot to run easily, and possessing the correct analysis to get maximum mechanical properties after annealing.

It should be unnecessary to give a complete description of an air furnace, as it is well known, but its principal features are detailed in Figs. 1 to 4. The furnace referred to has a capacity of 15 tons and possesses the following dimensions:—Length of bath, 25 ft.; width of bath, 8 ft.; depth of bath, 6 ins.; size of grate, 5 ft. 3 ins. by 8 ft.; ratio of grate to bath area, 1 to 5; and blast pressure, 4 ins.

The weights of material entering into construction are:—Steel plate, 7 tons; rivets, 500 lbs.; cast iron, 4,000 lbs.; wrought-iron bars, 750 lbs.; standard rails, 2,000 lbs.; and steel castings, 4,000 lbs.

The quantities of best-quality firebricks are:—15,000 squares, 1,000 side arch, 90 end arch (for the bung), 10 specials (for the damper arrangement), and 4 specials for the tap hole. Of second-quality firebricks the quantities needed are 20,000 squares and 10,000 48-in. circle bricks. Additionally, some 15 tons of fireclay are used.

Composition of the Charge.

Before calculating the charge, the degree of oxidation taking place during melting must be known. A well-worked furnace must give practically the same heat every day, and the various constituents must be oxidised normally. The first few heats must be regarded as being of trial character, but the metallurgist must know how to work his furnace after a maximum of three heats.

The composition of the charge is very important on the final result, and one must be certain that the analyses of the pig-iron are correct; whilst the influence of all raw material used in the charge must be known. Additionally, the metallurgist must know the influence and action of each constituent and their degree of oxidation, according to the way the furnace is working, either reducing or oxidising. Further, he will have to calculate the charge, so as to obtain a metal of such analysis that after annealing the best mechanical and physical properties are obtained. The following material should be stocked:—

Pig-iron.—(1) Ordinary; (2) hematite; (3) high Si hematite; and (4) high-phosphorus iron.

Ferros.—20 per cent. Mn spiegel and 25 per cent. ferro-silicon.

Hematites.

It is necessary to carry in stock pig-iron with a wide range of silicon and manganese content, the limits being confined between the following:—

White Pig-Iron.—TC, 2.90; Si, 0.80; Mn, 0.30; S, 0.05; and P, 0.06 per cent. *Grey Iron.*—TC, 3.90; Si, 3.45; Mn, 0.90; S, 0.03; and P, 0.11 per cent.

White pig-iron is used in case of a shortage of white scrap, and it is desirable to have on hand a truck load of pig-iron of the same silicon and manganese content as the calculated analysis. Thus, one containing Si 1.30 and Mn 0.54 per cent. will be very useful for additions when the charge is weighed up.

Phosphoric Iron.

This is used to bring the phosphorus to the required content, as it can reach 0.22 per cent. in the casting without serious harm.

Below this amount the whole of phosphorus remains in solution with the iron, but about 0.25 per cent. free Fe_3P separates out, weakening the metal, producing hard spots and inducing warping during annealing. As a rule phosphoric iron does not constitute more than 2 per cent. of the charge. The ferro alloys are used for additions during the melt.

Steel.

Bloom ends or rails can be used, but rails, ends welded with "Thermit," must be avoided as the aluminium has a much stronger graphitising action than the silicon. Chromium determinations must be made on all lots of steel received, as with more than 0.10 per cent. Cr annealing difficulties arise. Nickel does not interfere with annealing, but on the contrary improves the metal.

Making the Initial Charge.

From previous experience it is known that the oxidation of the constituents is as follows:—

	Calculated Analysis. Per Cent.	Analysis Obtained. Per Cent.	Loss Percentage. Per Cent.
Si ...	1.50	1.00	33
Mn ...	0.60	0.30	50
C ...	3.30	2.67	20

This composition should give a white "plug," a "plug" being a test taken during the melt, about 30 minutes before tapping. For the sake of clarity the different terms used in the author's air furnace practice are defined as follows:—

High Heat is a melt slightly or badly oxidised, as shown by the fracture of the plug and the fluidity of the metal.

Soft Heat refers to metal not oxidised, but which is on the grey side when the plug is either grey or mottled.

Hole in the Bottom.—When making up the bottom of the furnace, if a part of it has not been rammed hard enough, or left unprotected with boards when charging with iron, it may cause a cavity, and the depth of bath being greater in that place than elsewhere, the metal does not attain the proper pouring temperature. For the first heat it is best to work out the charge on the safe side, *i.e.*, on the soft side, using a calculated analysis of T.C. 3.50, Si 1.65, and Mn 0.65 per cent., and a final analysis of C 2.80, Si 1.10, and Mn 0.33 per cent. Under these conditions the plug will be mottled. The total time of melting will be noted, as well as all other pertinent records.

The next heat will be calculated so as to obtain a white plug, and aim at a silicon content of 1 per cent., with 0.26 per cent. Mn and 2.60 per cent. T.C. The third heat should be perfect, and the analysis of the metal must be near to T.C., 2.60 to 2.45; Si, 0.80; Mn, 0.26; S, 0.05; and P, 0.19 per cent., as this is considered to be the best analysis for malleable iron.

Besides the laboratory control of raw material, a strict control must be instituted as to the weighing of the different raw material, and the manner they are loaded into the furnace. Care must be taken that the scrap is placed first, and as near as possible to the front bridge—that is, the hottest part of the furnace; on that the steel, if there is any, is sandwiched in between the scrap and the pig-iron, which will be on the top.

All bungs should be inspected to ensure that no bricks are cracked and liable to fall in the bath. Further, the grate bars must be seen to, for if they are eaten away they might fall in the ash pit, thus stopping the firing, with serious consequences on the heat.

If the first plug shows a grey or mottled fracture combined with a fair pouring temperature, no real harm has been done, and the only remedy is to continue firing and take another plug about 30 minutes later, when as a rule the iron is hot and the plug is white. If the fracture of the plug is white, and still the iron is not hot, giving what is called a very high heat, additions of spiegel and ferro-silicon are necessary. These conditions may be due to the human factor, or perhaps the coal.

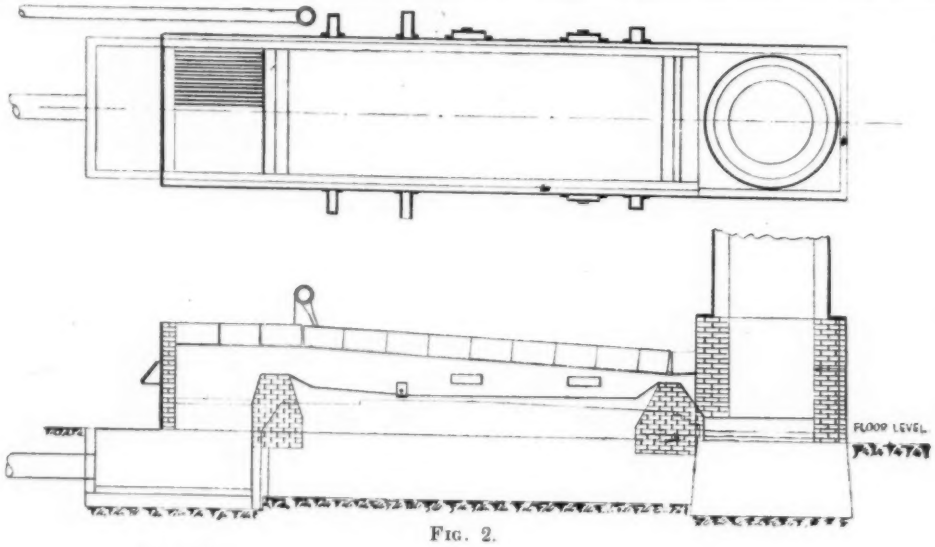

FIG. 2.

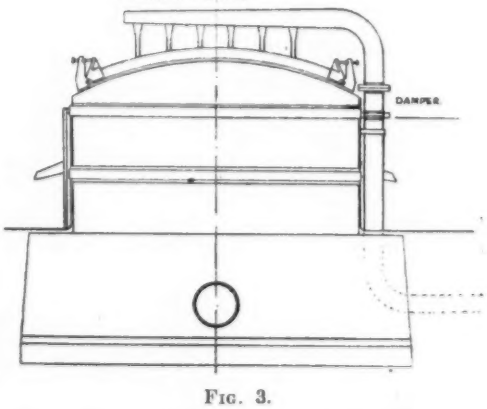

FIG. 3.

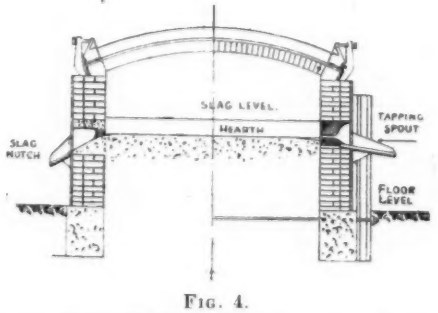

FIG. 4.

These remarks apply to hand-fired air furnace. With powdered coal the working is much easier. As a general rule, when melting a scrap on the soft side, the calculated analysis must be worked on the high side; and conversely with "high-heat" scrap, the composition of the charge must be on the soft side. Bearing this in mind, orders must be given to the foundry that the scrap from each heat must be kept separate.

(*To be continued.*)

THE NEW SOUTH WALES GOVERNMENT have placed the contract for the whole of the power and pumping machinery required for the new Walsh Island floating dock with Worthington-Simpson, Limited, Queen's House, Kingsway, London, W.C.2, and Newark-on-Trent. The plant consists of three Worthington-Simpson 360-h.p. solid-injection oil engines, each coupled to 230-kw. generators, together with the necessary centrifugal pumping plant, motors and switchgear.

Carbon in Cast Iron.*

By Paul Ropsy, Managing Director of the Société Belge Griffin, Merxem-Anvers.

This Paper, in the preparation of which M. Gustave Libert, technical director, and M. Edmond Lermigneau, head of the laboratory of the Société Belge Griffin have largely collaborated, is merely a résumé of certain practical studies and laboratory work.

The part played by carbon in cast iron constitutes, of course, the entire history of this metal. In his work on metallography Mr. Howe states that from the softest iron to the hardest white iron the essential difference consists only in the C content. Electrolytic iron, in fact, is practically free from it, being ductile and soft. A horse-shoe nail contains but little more; it can still be bent by hand and is nearly as ductile as the former metal. Then comes the series of steels, soft, semi-soft, and hard, up to the extra hard, which end at the theoretical point of 1.7 per cent. In practice, or rather, commercially, this content reaches about 2.5 per cent., owing to the mechanical properties of these alloys.

Theoretically, then, the series of cast irons begins at 1.7 and ends at 6.7 per cent., which is also the theoretical point of white cast iron par excellence. Between these two extreme points there is an uninterrupted series of Fe-C alloys, some of the characteristics of which will now be examined. In order to regularise our ideas we shall examine the effect produced by C successively in the liquid, pasty and solid metal. Afterwards certain particulars with reference to the determination of C in cast iron will be given.

Liquid Metal.

While the metal is melting the C is probably dissolved in the form of iron carbide, and its content

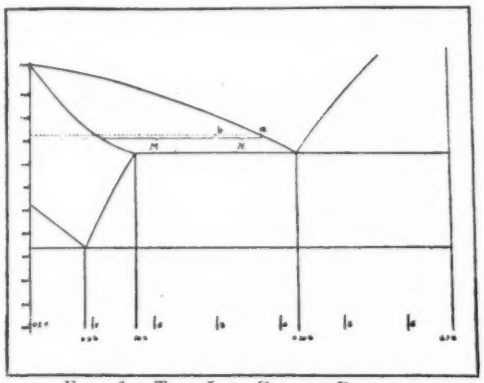

FIG. 1.—THE IRON-CARBON DIAGRAM.

influences the melting point of the metal, as may be seen from the Fe-C diagram The melting point of electrolytic iron is about 1,500 deg. C., and that of eutectic cast iron with 4.3 per cent. C is 1,135 deg. Between these two points lies the series of hypo-eutectic cast irons, the melting point of each alloy varying with the C content. If in the foundry it is customary to cast at about the melting point or even below it, in view of the fact that the C content always varies a little, the necessity will at once be seen of varying the temperature in order to maintain the same viscosity. At first sight it seems paradoxical to talk of casting below the melting point, but this is nevertheless frequent. In chilled cast-iron practice certain castings, as will be seen later, are always poured after the first cooling critical point. The following figures will make the matter clear:—In the case of a metal with 3.8 per cent. of C (point *a*) it is seen that at 1,230 deg. it is still entirely liquid, while at the same temperature a metal with a 3 per cent. content (point *b*) is already in the pasty condition; in other words, the first crystals of austenite are beginning to be deposited in the mass (Fig. 1).

In the liquid state, as is well known, metals with different C contents, although at the same temperature, do not show the same viscosity, and it is for this reason that the pyrometer alone is inadequate for the control of the operation of casting and that it must be supplemented by the eye of an experienced workman. Certain elements, such as phosphorus, have a much greater influence on the viscosity of the metal than C.

The C in molten metal is in a dissolved condition. In connection with recent researches on the superheating of cast iron, Professor Piwowarsky expressed the opinion that at the normal melting temperature the graphite is not entirely dissolved, but remains partially in the form of minute particles which, during solidification, play the part of crystallisation nuclei and thus facilitate the formation of large graphite laminæ, which injure the properties of the metal. In fact, in the hardened part of a chilled casting (cooled, therefore, very rapidly and solidified almost without transformation) there remains up to 0.15 per cent. of C in the form of graphite. To effect this determination with precision at least 5 grams of metal must be dissolved, the determination of graphite being carried out on the residue. The microscope, even with the highest magnifications, does not show this graphite, probably because it is disseminated throughout the mass in the form of particles which are too minute.

Superheated metal frequently shows an improvement in its physical properties. Experiments carried out in the author's laboratories gave the following results, which are the average of six test pieces:—

Character of metal.		Transverse strength in kgs. per sq. mm.	Brinell hardness.
From the cupola furnace	not superheated ..	45.8	238
	Superheated to 1450° for 20 m.	49.3	248

The superheating was carried out in a Meker crucible furnace with a capacity of 22 lbs. The microscope, however, does not show that difference in appearance of the graphite which one was entitled to expect. Although the results after superheating were repeatedly superior, too much enthusiasm should not be shown regarding this method. The results, moreover, are sometimes contradictory. A mixture of ordinary casting hematite and Swedish pig was cast immediately after melting and gave an average of 47.5 kgs. per sq. mm. This mixture, when superheated under the same conditions as previously, showed 40.6 kgs. per sq. mm.

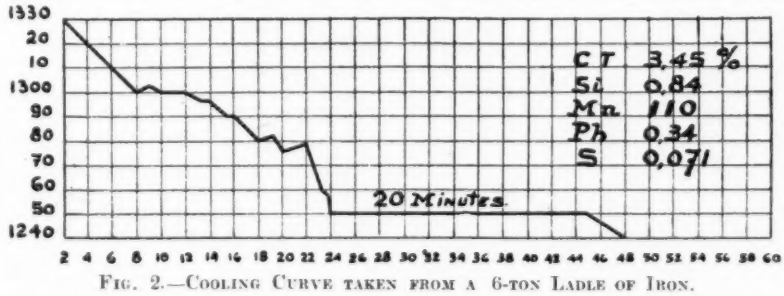

FIG. 2.—COOLING CURVE TAKEN FROM A 6-TON LADLE OF IRON.

* A Paper read before the Brussels Congress of the A.T.F.B.

Pasty Metal.

A metal is more or less pasty at the same temperature according to its C content. By glancing at the Fe-C diagram one may even ascertain the proportion of the liquid and the solid elements. A metal with a 3 per cent. C content at 1,230 deg. (point *b*) already contains N solid elements to M liquid elements, while that with a 3.8 per cent. C content, and at the same temperature, is only beginning to deposit its first austenite crystals. It is evident that the former has already passed its first critical point of solidification, while still retaining a temperature which is quite sufficient for pouring certain castings.

Fig. 2 shows examples of the critical point observed before casting in a ladle containing 6 tons of molten metal. The temperatures are shown as ordinates, and the time in minutes as abscissæ.

The temperatures were taken every two minutes with a pyrometer with a disappearing filament, and in order to prevent serious errors of observation three persons checked the taking of the temperatures. It is rather surprising to find that before the critical point there are some slight variations, while during the critical period the temperature remains absolutely stationary. This range is sometimes very long; that here shown lasted 20 minutes.

In another example, Fig. 3, only the C and the temperature alter to an appreciable extent.

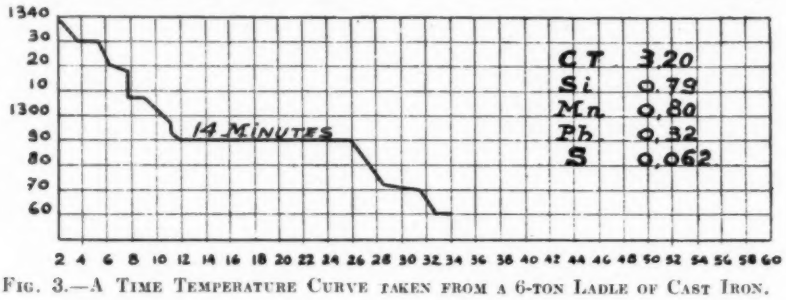

FIG. 3.—A TIME TEMPERATURE CURVE TAKEN FROM A 6-TON LADLE OF CAST IRON.

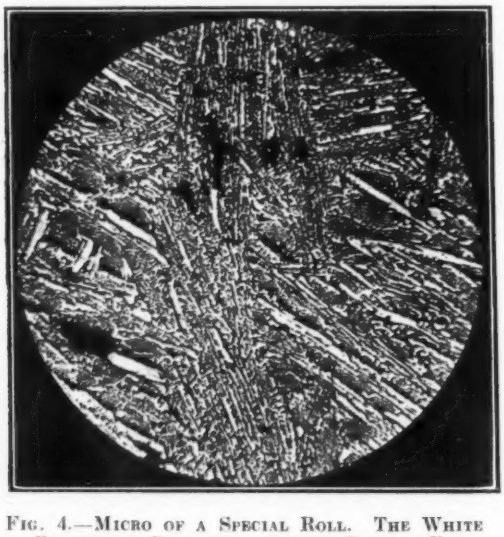

FIG. 4.—MICRO OF A SPECIAL ROLL. THE WHITE PORTION IS CEMENTITE AND THE BALANCE EUTECTIC × 80. ETCHED WITH PICRIC ACID.

Solid Metal.

Sudden and Rapid Cooling.—According to the rapidity of cooling, the metal is white, mottled or grey—that is to say, the carbon has remained in the form of cementite in the first case. In the others the cementite has been more or less decomposed into C and Fe, according to the reaction $Fe_3C = 3Fe + C$. This decomposition may take place even in the cementite of the pearlite, and may exhibit the extreme case of a ferrite and graphite structure.

These three cases are met with in hardened cast iron. The part poured against the chill is white. If the C content exceeds 4.3 the metal is hypereutectic; it has therefore deposited primary cementite and eutectic.

The illustration (Fig. 4) shows the hardened part of a special roll with a Brinell hardness of 500 and a C content of 4.45 per cent. The large white plates are primary cementite, the remainder being eutectic. This composition is sought only for purposes necessitating very great hardness, while the strength of the casting plays a subordinate part, the predominating industrial application of such cast iron. The white portion is formed of eutectic and primary austenite; the eutectic naturally increases in proportion as the carbon content of 4.3 per cent. is reached. The austenite may be decomposed into martensite or pearlite, according to the rapidity of cooling or the subsequent reheating (Fig. 5).

The degree of hardness is directly related to the C contents. In the series of photographs (Figs. 6-17) the C and the hardness diminish together. This is perfectly natural, as the more C there is, the more the cementite, and cementite is the hardest of the constituents of cast iron.

Numerous measurements of the hardness of cast iron have enabled us to note the relations between the different methods. The hardness of a metal can be measured in various ways, but the method which appears most suitable for the needs of the chilled castings industry and is, in the author's opinion, the most scientific, is certainly that of Brinell. Certain portable apparatus, which have been placed on the market, also give figures approximating more or less to the actual Brinell figures. But there is another device, which is habitually used in America, and which likewise gives interesting figures, viz., Shore's scleroscope. These two methods, however, are totally different, and it would be interesting to learn how it is possible to make use of the second for the purpose of obtaining the results of the first. Yet Belgian foundrymen have probably been told by British or American agents that by means of a scleroscope and a table they could determine the Brinell figure. After an investigation carried out in his laboratories the author is convinced that they are mistaken. Repeated tests were made, and the adjacent photographs show two of these.

FIG. 5.—THE CAST IRON EUTECTIC AND PRIMARY AUSTENITE × 80.

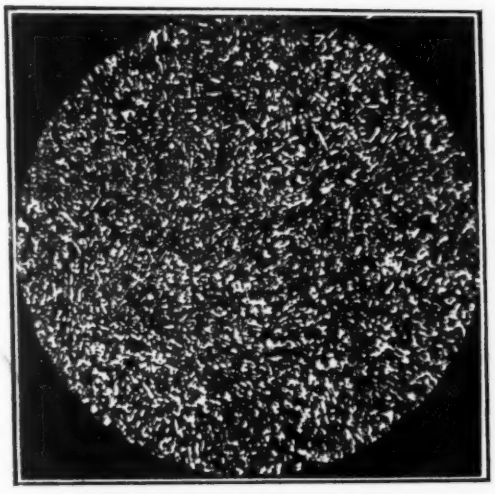

FIG. 6.—T.C. = 4.5 PER CENT.; BRINELL = 550; × 80. ETCHED WITH PICRIC ACID.

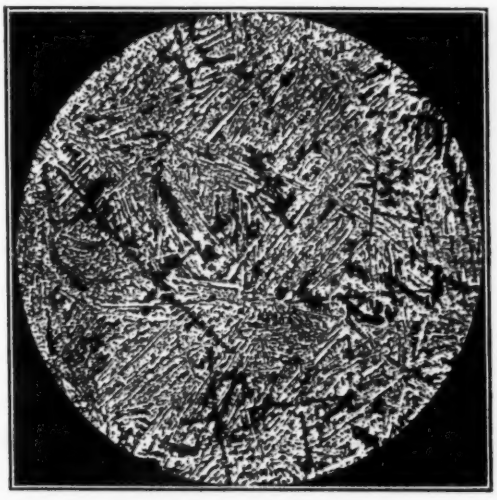

FIG. 7.—T.C. = 4.10; BRINELL = 512. THE STRUCTURE IS PRACTICALLY EUTECTIC × 80. ETCHED WITH PICRIC ACID.

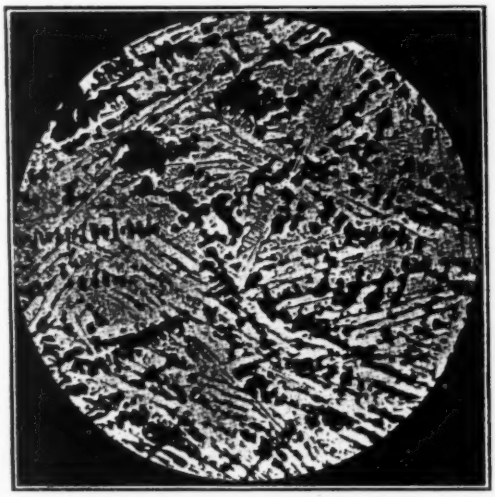

FIG. 8.—T.C. = 3.8; BRINELL = 495. THE PRIMARY AUSTENITE IS BEGINNING TO SHOW (BLACK) × 80. ETCHED WITH PICRIC ACID.

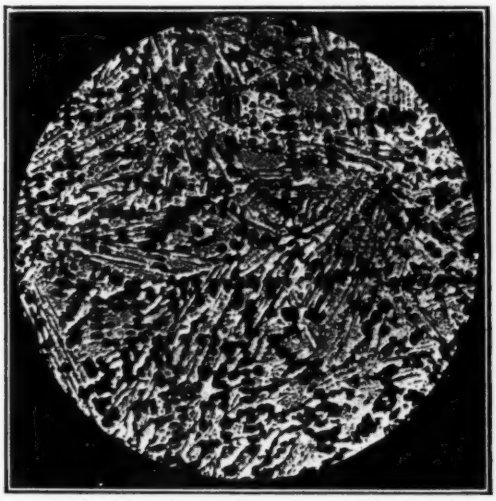

FIG. 9.—T.C = 3.60; BRINELL = 460; × 80. ETCHED WITH PICRIC ACID.

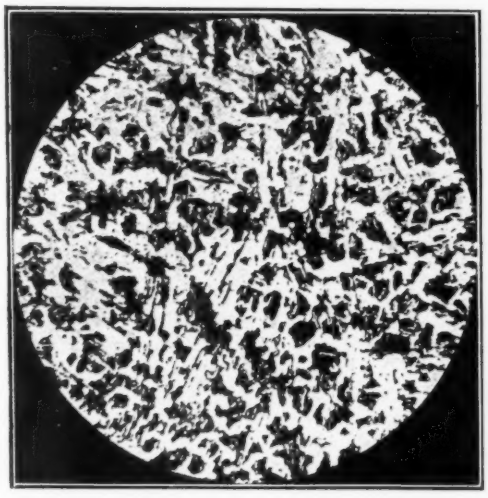

FIG. 10.—T.C. = 3.30; BRINELL = 320; × 80. ETCHED WITH PICRIC ACID.

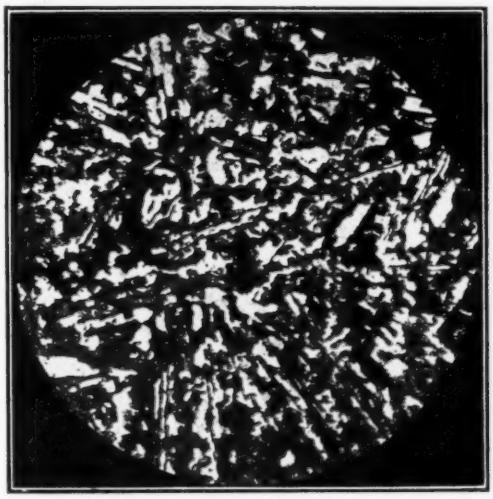

FIG. 11.—THE STRUCTURE OF THIS SECTION (T.C. = 4.5) HAS BEEN MODIFIED BY A HIGH-IRON CONTENT × 360.

FIGS. 6 TO 10.—HARDNESS IN CAST IRON IN RELATION TO CARBON CONTENT.

XUM

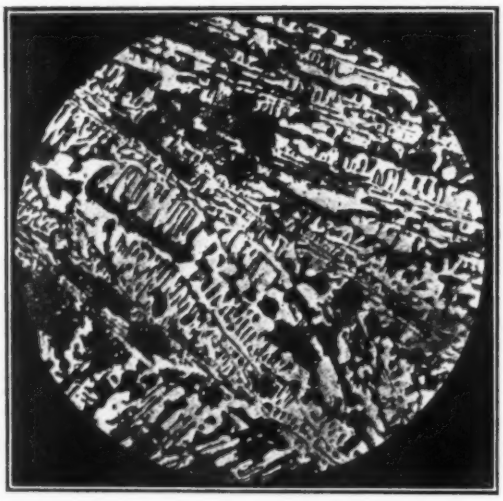

Fig. 12.—T.C. = 4.10. The General Aspect of the Eutectic is more Clearly Defined × 360.

Fig. 13.—T.C. = 3.80. Here the Pearlite of the Primary Austenite is Beginning to Show × 360.

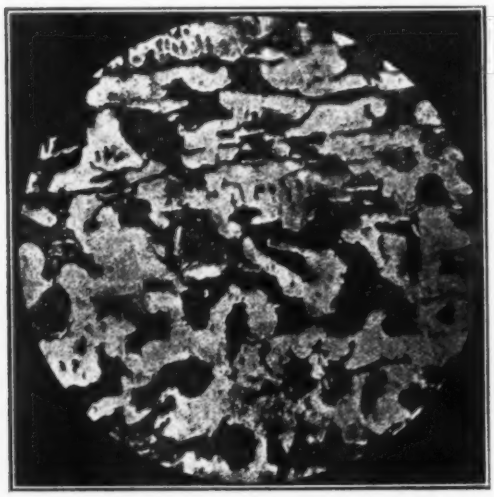

Fig. 14.—T.C. = 3.60. A few Needles of Cementite existing amongst the Primary Austenite have not been able to Join the Mass of the Cementite × 360.

Fig. 15.—T.C. = 3.30 per cent. The Pearlite is now Clearly Visible × 360.

Figs. 11 to 15.—The Appearance of the Micros shown in Figs. 6 to 10 but at 360 dias.

Fig. 16.—Pearlite and Graphite × 150. Etched with Picric Acid.

Fig. 17.—Here the Cementite has been Decomposed into Iron and Carbon. The Graphite is Enclosed in the Ferrite × 500. Etched with Picric Acid.

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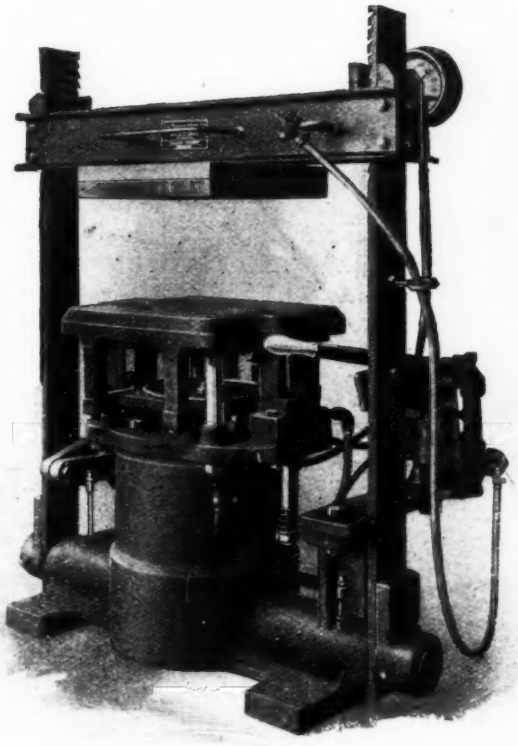

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Works: TOTTENHAM, LONDON, N.17.

Between these two extremes, then, it is possible, by varying the elements in the metal, to obtain all the intermediate figures.

(*b*) *Slow Cooling.*—This cooling may be more or less slow, and the metal may exhibit three aspects: (1) When the time has been too short to enable all the cementite to be decomposed there remain in the mass clusters of cementite in a pearlite matrix. This applies to the mottled portion of chilled cast iron; (2) the cooling may be sufficiently slow to enable all the free cementite to decompose without permitting the cementite of the pearlite to do so. This applies to the centre of good chilled castings. It is clear that silicon and manganese may also produce analagous effects, but in the case which particularly concerns the manufacture of chilled castings, the pearlite structure can be brought about by the scientific determination of the cooling period. The C, Si, Mn, P, and S must, for various reasons, be proportioned at less than 0.10 per cent. approximately; and (3) the third case may occur with very slow cooling. The decomposition extends to the cementite of the

FIG. 18.—THIS SECTION HAS BEEN ETCHED WITH PICRIC ACID AND SODIUM PICRATE. THE CEMENTITE IS TINTED, THE PIRITE IS WHITE AND THE BALANCE IS PEARLITE AND GRAPHITE × 500.

pearlite. The structure is ferrite + pearlite + graphite, and the metal is of inferior quality. This decomposition does not always take place regularly, and the structure obtained may be cementite + pearlite + graphite, but this metal also is of poor quality. By reducing the picric acid etching to 5 or 6 minutes the cementite assumes different colours.

Finally, there may be the extreme case of a metal in which the decomposition of the pearlite has continued to the end, in which case the result would be graphite + ferrite.

Determination of Carbon.

The Wiborgh process is classical and well-known. The process by direct combustion is remarkably accurate, and is in current use. The errors noted from time to time nearly always arise from the sampling, particularly in the case of grey cast iron.

Metallography is frequently capable of rendering great service in regard to the determination of C. As the metal, however, is much less homogeneous than steel, greater caution is requisite in reaching conclusions. The simple process of examining surfaces, which is used for steel, cannot be employed in many cases except after two different etchings. By etching with picric acid the pearlite becames black, while the ferrite and cementite remain white. It would therefore be impossible to come to a decision after this etching alone, and it is necessary to follow it with another etching with sodium picrate, which blackens the cementite (Fig. 18). If care is taken not to carry the etching too far the cementite appears in red, or at least coloured, and it is easier to estimate it directly. This determination is more interesting from the point of view of the combined carbon than that of the total carbon.

An observation of pearlite and ferrite shows a combined C content of 0.9 and in inverse ratio to the ferrite. Pearlite alone shows a combined C content of 0.9. Pearlite + cementite shows a composition with over 0.9 per cent. of combined C, the combined content being greater in proportion to the amount of cementite. The proportion of the areas may even be taken, remembering that the pearlite = 0.9, while the cementite = 6.7. In the case of a metal containing ferrite + pearlite + cementite the process becomes much more difficult, and can hardly be of any use except in the case of very serious errors in composition.

A final method, used but little as yet, is that of plotting the cooling curve of the metal. Obviously this method of determination can be of service only in special cases, for example in producing large castings which are always of identical composition. The melting point, in fact, is dependent upon factors which also exercise an influence on the viscosity of the metal. A study of the cooling curves in the foundry itself will assuredly help to throw light on the complex part played by C in cast iron.

FIG. 19.—CEMENTITE AND PEARLITE GRAPHITE BEING HIDDEN BY THE REAGENT × 80. ETCHED WITH PICRIC ACID.

In passing rapidly over this extensive field of study it has not been the author's intention to deal with the problem thoroughly, but only to touch upon it superficially. This Paper is merely intended to serve as a guide or plan of work, not as a finished research. It was thought that it would prove useful to submit some of the results which the author's laboratory researches have enabled him to obtain.

Basic Bessemer Steel and British Standard Specifications for Railway Rails.

The British Engineering Standards Association have decided to remove all reference to the basic Bessemer process from the B.S. Specification No. 9-1922, Bull Head Railway Rails, and No. 11-1926, Flat Bottom Railway Rails, since the use of this process is no longer in accord with British practice.

Effect has been given to this decision by the Association in the current editions of the specifications of slips giving the detailed alterations required to the clauses affected.

For a copy of these slips application should be made to the Publication Sales Department, B.E.S.A., 28, Victoria Street, S.W.1, accompanied by a stamped addressed envelope.

We regret to record the death of Sir J. C. Davies, the managing director of Baldwins, Limited. During the war he was one of the founders of the Swansea National Shell Factory. For this he was created C.B.E. He was knighted in 1922.

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BY 30 to 50 PER CENT

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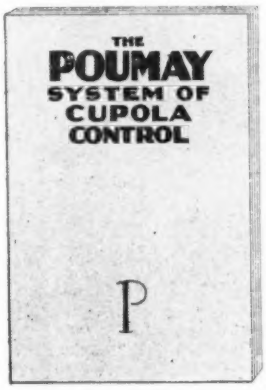
of cupola control and make this astonishing reduction in your fuel bill. The fuel is made to yield its full calorific value, melting the metal very rapidly and keeping it at a high temperature. Oxidisation in the cupola is eliminated and metallic loss is reduced to a minimum, the metal remaining in a very pure state.

"We had a successful run with the Poumay cupola on Wednesday and it is also doing well to-day. The results are very similar to Monday's run and we are taking steps to keep up pace in charging. Using 7% of coke between charges, we get good hot metal all day at a saving of 24 cwt. of coke and one hour in time over old cupola. We find that sulphur is reduced from .069% to .041%.

"The cupola is working to-day and seems better than we have had yet. Fifty charges were taken out without a stop and metal is very hot. You might write us what the licence would amount to for conversion of second 54" cupola."



The above is what Messrs. Cameron & Roberton, South Bank Ironworks, Kirkintillock, say about the Poumay system.

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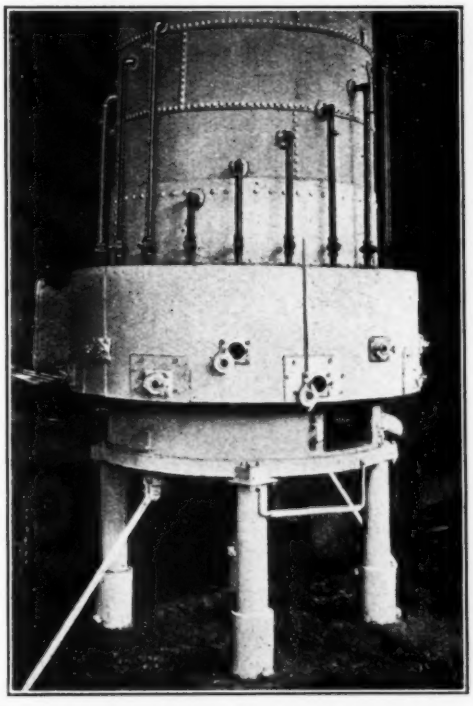
which gives further testimony as to the remarkable economy effected by the Poumay system. The booklet is posted free by return.



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O. & S.

Trade Talk.

THE AMMAN TINPLATE WORKS belonging to the Grovesend Company is restarting work next Monday.

ROBERT THOMPSON & SONS, LIMITED, of Southwick, have received an order for two vessels for the Claymore Shipping Company, Limited, of Cardiff.

THE LONDON & NORTH-EASTERN RAILWAY are building ten "Pacific" locomotives at their works. This is the type of locomotive known as the "Flying Scotsman."

THE SEVENTY-NINTH ANNIVERSARY FESTIVAL of the Royal Metal Trades Pension and Benevolent Society this year will be held at the Hotel Cecil on Tuesday, October 11.

THE BRITON FERRY IRONWORKS of Baldwins, Limited, and part of Briton Ferry Steelworks have closed down through trade depression, about 600 men being affected.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LIMITED, state that the Admiralty have placed another contract with them for a further supply of Siemens helical traction lamps.

RANSOMES AND RAPIER, LIMITED, Ipswich, have received a £170,000 contract for sluice gates and the operating machines in connection with the new barrage at Nag Hammadi on the Nile.

THE EMPLOYERS connected with the National Light Castings Industry Association have made a claim to the trade unions for a reduction of 12½ per cent. in the rates of all workers engaged in the manufacture of baths. The reason given in support of the claim is keen foreign competition. Both sides have made compromise suggestions.

IT IS UNDERSTOOD that the rolling mills and steelworks of J. Spencer & Sons, Limited, have been purchased by Thos. W. Ward, Limited, Sheffield. Spencer's works are situated at Newburn, on the north bank of the river Tyne, about six miles west of Newcastle. The freehold site contains 43 acres, with river frontage of 1,100 yards and extensive railway sidings. Included in the plant are 12 Siemens-Martin acid process steel-melting furnaces, each 40 tons capacity, complete rolling-mill plant of the most modern kind for boiler and shipplates, spring steel and bars.

THE BUENOS AYRES GREAT SOUTHERN RAILWAY COMPANY have placed orders with British manufacturers for 50 three-cylinder-type goods locomotives with double bogie tenders, of an aggregate value of approximately £350,000. Thirty of these locomotives will be made by Sir W. G. Armstrong, Whitworth & Company, Limited, at Newcastle, and the remaining 20 by Messrs. Beyer, Peacock & Company, Limited, of Manchester. Sir W. G. Armstrong, Whitworth & Company, Limited, have also secured a contract for 26 locomotive boilers for the Bengal Nagpur Railway Company, Limited.

MESSRS. JAMES GORDON & COMPANY, LIMITED, Windsor House, Kingsway, London, W.C.2, inform us that they have taken over complete patent rights for the British Empire, except Canada, and also for all other European countries and their colonies, of :—Hagan patent automatic regulation for combustion, boiler houses, etc., Hall patent system of boiler-water conditioning, and the Hall patent steam separator; they also state that the new Hagan department is under the management of Mr. J. E. O'Breen, who has had a wide experience with different apparatus during the time he was with the Hagan Corporation of Pittsburgh, Pa.

THE ELECTRICITY COMMITTEE have evolved and passed on to the Central Electricity Board the first part of the scheme which is to be carried out under the Electricity Supply Act. Under the new scheme certain of the stations will close down in slack periods, the supplies coming from those stations which continue. By this means it is hoped eventually very substantially to reduce the price of electric current, and to supply places at present out of the reach of any electrical undertakings. The country is to be divided into areas, and, the first, it is learned, will be London, the Home Counties, and the South-East of England. Next will be the industrial Midlands.

THE NAMES OF THE UNDERMENTIONED COMPANIES have been struck off the Register of Joint Stock Companies and such companies are dissolved : Acme Engineering Company (London), Limited, Alwin Engineering Company, Limited, Bromford Tools and Engineering Company, Limited, Croydon Art Metal Company, Limited, Empire (Alloy) Steel Corporation, Limited, Humphrey Pump Company, Limited, Kidsgrove Steel, Iron and Coal Company, Limited, Penlan Colliery Company, Limited, Pleck Foundry Company, Limited, Ritchie Concrete Engineering and Shipbuilding Company, Limited, and the Trafalgar Colliery Company, Limited.

Contracts Open.

Darlington, September 14.—Iron and steel ware (including cogs, nails, etc.) and cast-iron pipes, for six months ending March 31, 1928, for the Town Council. The Borough Surveyor and Waterworks Engineer, Town Hall, Darlington.

Johannesburg, October 7.—One centrifugal pump, for the Engineer's Department, Rand Water Board. The Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. A.X. 5,021.)

Liverpool, September 13.—Pumping plant, consisting of small electrically-driven centrifugal pumps, for the Liverpool Corporation. The Water Engineer, 55, Dale Street, Liverpool. (Fee £2 2s., returnable.)

Port Talbot, September 17.—12-in. and 10-in. cast-iron water mains, etc., for the Borough Council. The Borough Engineer, Municipal Buildings, Aberavon. (Fee £2 2s., returnable.)

South Shields, September 19. — Conveyor and mechanical equipment, for the Town Council. Mr. S. G. Stanton, borough engineer, Town Hall, South Shields.

Stoke-on-Trent, September 5.—(7) Cast-iron work for six months ending March 31, 1928, for the City Council. The City Surveyor, Town Hall, Stoke-on-Trent.

Stourbridge, September 13.—Pumping plant, for the Stourbridge and District Water Board. Mr. G. Plant Deeley, the consulting engineer, 13, Church Street, Stourbridge. (Fee £3 3s., returnable.)

Tipton, September 8.—(5) Lamp columns for six months ending March 31, 1928, for the Urban District Council. The Gas Manager, Gasworks, Alexandra Road, Tipton.

Wallasey, September 17.—50-ton overhead electric travelling crane, for the Corporation. Mr. B. T. Hawkins, the engineer and manager, Electricity Department, Seaview Road, Wallasey.

Wellington, N.Z., September 20.—Cast-iron water pipes, tees, fire hydrants, surface boxes, sluice valves and crosses, for the Public Works Department, New Zealand. The Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Ref. A.X. 5,031.)

Welwyn Garden City, September 6.—40 cast-iron lamp columns, with lanterns complete, for the Welwyn Urban District Council. Capt. W. E. James, surveyor, Council Offices, 7, Bridge Road, Welwyn Garden City, Herts. (Fee £2 2s., returnable.)

New Companies.

Banner & Hibbert, Limited, 40, Napier Road, Wolverhampton.—Capital £5,000 in £1 shares. Iron and steel merchants, etc.

Bernard A. Daniel, Limited, 165, Fenchurch Street, E.C.3.—Capital £250 in £1 shares. Pig-iron manufacturers. Directors: B. A. Daniel and Mrs. J. W. Daniel.

High Houseslip Ganister Company, Limited.—To take over the business of a ganister mine owner carried on at High Houseslip, Lanchester, Durham. Capital, £1,500 in £1 shares. Directors: G. Nevins, 17, South Garesfield, Rowlands Gill; H. Cockburn, and G. Brandon.

R. J. Hunt & Son, Limited, 15, Berkley Street, Birmingham.—Capital £6,000 in £1 shares. Engineers, founders, etc. Directors: G. E. Hunt, C. Wright and R. J. Hunt.

J. L. Larkworthy, Limited.—Capital £5,000 in £1 shares, to take over the business of engineers carried on at Lowesmoor Ironworks, Worcester. Directors: H. S. Dickson, D. B. Dickson and W. F. Crockett.

Leach & Son (Ilford), Limited.—Capital £10,000. Ironfounders, etc., carried on at 8, The Facade, High Road, Goodmayes, Essex, and elsewhere.

Milliken Brothers & Blaw-Knox, 14, Norfolk Street, Strand, W.C.2.—Capital £20,000 in £1 shares, to carry on the business of iron, brass and steel founders, etc.

New Bronze Company, Limited, 57, Kingsway, W.C.2.—Capital £5,000 in 4,500 10 per cent. cumulative preference shares of £1 each and 10,000 ordinary shares of 1s. each. Iron, bronze and brass founders, smelters, etc.

Edward Norman, Limited.—Capital £1,000 in £1 shares. Engineers. Directors: E. J. H. Norman, 23, Budge Row, E.C.4, and F. G. Hedgeland.

Steel Union Trading Company (Great Britain), Limited, Bilbao House, 36-38, New Broad Street, E.C.2.—Capital £10,000 in £1 shares. Ironmasters, founders etc. Directors: G. Oliver, K. Schirner, O. Schurr, T. Urlichs, R. H. Ferguson, D. Gabrielsen and E. L. F. Archdeacon.

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IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—The recent reduction in Cleveland iron, as announced in last week's report, has so far proved an immediate success, this long-expected movement by the ironmasters having already given a gratifying stimulus to local consumers' demands, has led to an encouraging expansion of business. Thus far, however, buying has been chiefly on home account, notwithstanding the extra concession granted on purchases for shipment, which are still subject to keen competition from Continental producers, who are more favourably placed in the matter of prices as concerns Scottish buyers of foundry pig. On the other hand, there are buyers abroad who are prepared to pay more for Cleveland iron, and as the margin of price narrows the number of such buyers may increase. The current prices of Cleveland iron are:—No. 1 foundry, 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; No. 4 forge, 66s. All these prices are subject to a discount of 2s. 6d. per ton for 500-ton lots for Scotland or abroad. On the North-West Coast conditions remain unchanged, the current quotation for Bessemer mixed numbers being fixed at 75s. per ton at works.

LANCASHIRE.—Corresponding with the price movements in the Tees-side area, local markets for foundry pig have been pleasantly surprised by similar action on the part of makers of Derbyshire brands, whose quotation for No. 3 is on the basis of 66s. 6d. at works, or 74s. 6d. per ton delivered Manchester or equal, with Staffordshire quality unchanged at about 75s. and Scottish at round 92s. 6d., both delivered.

THE MIDLANDS.—In this area demand for foundry iron continues on a moderate scale, and is mostly for immediate use. Ample supplies of Northants No. 3 are on offer at 60s. at furnaces, and several Derbyshire makers are ready to take 65s. at furnaces, the North Staffordshire makers following at the same level. Scotch iron is further reduced to 91s. 6d. delivered, and small supplies are coming through at this level.

SCOTLAND.—Prices in the local markets are again weaker, with No. 3 Scotch foundry quoted 75s. per ton f.o.t. furnaces. The light casting trade is rather quiet, with only a limited demand even for Continental iron.

Finished Iron.

Reductions decided upon last week by Lancashire bar-iron manufacturers were not unexpected, although the extent of the "cuts" came as a surprise to a good many people. They are, however, in the nature of a determined attempt to bring out business. For some time now makers in most instances have been able to work no more than the equivalent of half-time, and if by increased operations overhead charges can be reduced, the reductions will probably be regarded as justified. With the cut of £1 a ton in the case of crown bars, and of 10s. in second-quality material current quotations for these now stand at £10 and £9 10s.

Steel.

In the market for semi-products business continues quiet. Prices have hardened on the Continent, due no doubt to makers having full order books on home account. Whilst this feature is disconcerting to re-rollers in this country, steel manufacturers welcome it as tending to restrict imports, although it is recognised that something very much more substantial is needed to level up British and Continental prices sufficiently to divert to manufacturers in this country any considerable proportion of the large tonnages of iron and steel now being imported. There is no change in the condition of the tinplate market, which remains dull. The demand does not improve, and the tone continues to be pessimistic. Many mills are idle, and there is little prospect of more being restarted for some time. Prices for I.C., 20 x 14 x 112 sheets remain at between 18s. 4½d. and 18s. 7½d.

Scrap.

Consumers of this class of foundry material continue to limit purchases to the barest limits, and, having mostly substantial stocks in hand, are in no hurry to increase their commitments. In the Scottish markets cast-iron scrap is still in abundant supply, with prices easy, and first-class machinery cast-iron scrap is being disposed of freely around 70s. per ton, and for heavy ordinary 5s. per ton less. Light cast-iron scrap is unchanged, around 57s. 6d. to 58s. 6d. per ton. The above prices are all per ton, delivered f.o.t. consumers' works.

Metals.

Copper.—As usually expected at the close of the holiday month, the markets for base metals disclose the return of a more active interest, although, so far, standard copper values have touched lower levels, as a consequence of adverse American advices. It is stated, however, that consumers in Europe are existing on small supplies, and that a return to more active conditions in the market cannot be long delayed; this in spite of the fact that Germany in June showed a great interest in this metal.

Official closing prices of standard copper have been as follow :—

Cash : Thursday, £54 10s. to £54 11s. 3d.; Friday, £54 12s. 6d. to £54 13s. 9d.; Monday, £55 1s. 3d. to £55 2s. 6d.; Tuesday, £55 3s. 9d. to £55 5s.; Wednesday, £54 18s. 9d. to £55.

Three Months : Thursday, £54 17s. 6d. to £54 18s. 9d.; Friday, £54 18s. 9d. to £55; Monday, £55 7s. 6d. to £55 10s.; Tuesday, £55 12s. 6d. to £55 13s. 9d.; Wednesday, £55 8s. 9d. to £55 10s.

Tin.—Fluctuating values have been the usual experience in this metal for some time, and the past week has been no exception in this respect, cash prices closing about £1 lower than at the previous week. The outlook for the near future is not by any means disappointing, as the period which has just passed consisted of the holiday season, when requirements are, as a rule, kept down to a low level.

Official closing prices of standard tin have been as under :—

Cash : Thursday, £290 to £290 5s.; Friday, £287 10s. to £287 12s. 6d.; Monday, £289 10s. to £289 15s.; Tuesday, £289 2s. 6d. to £289 7s. 6d; Wednesday, £289 10s. to £289 15s.

Three Months : Thursday, £285 5s. to £285 10s.; Friday, £283 12s. 6d. to £283 15s.; Monday, £285 5s. to £285 10s.; Tuesday, £285 to £285 5s.; Wednesday, £286 to £286 5s.

Spelter.—Movements in this section of the market have not been of a very extensive nature. The tone of the market has, as a rule, been fairly firm, although at times a slight sign of weakness has been apparent. There has been a slight lack of buying as a result of the Continent not appearing anxious to press sales.

The following are the week's prices :—

Ordinary : Thursday, £27 12s. 6d.; Friday, £27 11s. 3d.; Monday, £27 17s. 6d.; Tuesday, £27 18s. 9d.; Wednesday, £27 13s. 9d.

Lead.—The position in soft foreign pig has been variable; at times the amount of business done has been good, while at others less keenness has been shown in transacting business. The later tendency has been for sellers to be more reserved, with the result that prices have not tended to falter, which has given a somewhat firmer tone to the market.

The week's prices are appended :—

Soft foreign (prompt) : Thursday, £22 12s. 6d.; Friday, £22 7s. 6d.; Monday, £22 15s.; Tuesday, £22 10s.; Wednesday, £22 8s. 9d.

Company Reports.

Walkers, Parker & Company, Limited.—Interim dividend of 6d. per share, less tax.

Elliott's Metal Company, Limited.—Dividend, 2s. per share on the ord. shares, less tax.

United Strip & Bar Mills, Limited.—Half-yearly dividend on guaranteed cum. pref. shares, 8 per cent. per annum, less tax.

Scottish Iron and Steel Company, Limited.—Dividend on preference shares at rate of 6 per cent. per annum, less tax, for half-year.

D. Napier & Son, Limited.—Dividend at the rate of 8 per cent. per annum, less tax, on non-cumulative preference for half-year ending September 30, 1927.

Dorman, Long & Company, Limited.—Payment of nine months' dividends on the 6 per cent. cumulative preference shares in respect of year ended March 31 last.

Grayson Lowood & Company, Limited.—Profit, £1,427, making, with £962 brought in, a total of £2,389, which it is proposed to carry forward to next year's account.

Stewarts & Lloyds, Limited.—Interim dividend for half-year of 6 per cent. per annum on the preference shares and 10 per cent. per annum on the preferred ordinary shares.

BLACKING,
PLUMBAGO,
CORE GUM,
WHITE DUST,
COAL DUST.

ESTABLISHED 1863

JAS. DURRANS & SONS, LTD.

PHOENIX WORKS, PENISTONE, near SHEFFIELD.

Telephone :
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Manufacturers of

FOUNDRY EQUIPMENTS

LADLES,
FIRE BRICKS,
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CASTING CLEANERS,
PIPE NAILS,
SPRIGS,
WIRE BRUSHES,
BELLOWS,
CUPOLAS,
GANISTER,
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STUDS,
CHAPLETS,
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CORE ROPES,
BUCKETS,
SPADES, Etc.

Write for Illustrated Catalogue on Blacking and Foundry Requisites, also for our latest Price List.

PIG IRON
and
High Grade
CYLINDER
IRON
For Motor Castings.

FOUNDRY & FURNACE COKE

J. C. ABBOTT & Co LTD

LLOYD'S BANK CHAMBERS, NEW STREET, BIRMINGHAM.
TELEPHONE: MIDLAND 170.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	54	18	9
Three months	55	8	9
Electrolytic	62	0	0
Tough	59	0	0
Best selected	60	0	0
Sheets	86	0	0
India	72	0	0
Wire bars	62	5	0
Do. September	62	5	0
Do. October	62	5	0
Ingot bars	62	5	0
H.C. wire rods	66	15	0
Off. av. cash, July 54	11	8	5/16
Do. 3 mths. July 54	19	9	1/2
Do.,Sttlmnt. July 54	11	6	1/2
Do., Electro, July 60	6	6	1/2
Do., B.S., July 58	15	3	1/2
Aver. spot price copper, July 54	11	8	1/2
Do., wire bars, July 60	11	3	3/4
Solid drawn tubes		12	1/2d.
Brazed tubes		12	1/2d.
Wire		9	1/2d.

BRASS.

Solid drawn tubes	11 1/2d.
Brazed tubes	13 1/2d.
Rods, drawn	10 1/2d.
Rods, extd. or rlld.	7 1/2d.
Sheets to 10 w.g.	9 1/2d.
Wire	9 1/2d.
Rolled metal	9 1/2d.
Yellow metal rods	7 1/2d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8 1/2d.

TIN.

	£	s.	d.
Standard cash	289	10	0
Three months	286	0	0
English	287	0	0
Bars	289	5	0
Straits	292	15	0
Australian	292	15	0
Eastern	288	15	6
Banca	299	5	0
Off.avr.cash, July 288	16	3	
Do., 3 mths., July 281	19	3	1/2
Do., Sttlmt. July 288	15	11	1/2
Aver. spot, July 288	16	3	

SPELTER.

	£	s.	d.
Ordinary	27	13	9
Remelted	26	0	0
Hard	21	15	0
Electro 99.9	31	5	0
English	28	10	0
India	24	0	0
Zinc dust	37	0	0
Zinc ashes	10	10	0
Off. aver., July	28	3	0 1/4
Aver., spot, July	28	5	7

LEAD.

	£	s.	d.
Soft foreign ppt.	22	8	9
English	24	0	0
Off. average, July	23	14	2 1/2
Average spot, July	23	9	9 1/4

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	36	0	0
Do. V.M. ex whf.	34	10	0
Rods	42	0	0
Boiler plates	34	0	0
Battery plates	33	10	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	65	0	0
Chinese	46	10	0
Crude	37	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	21	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£8 15 0
45/50%	£12 10 0
75%	£19 15 0
Ferro-vanadium—	
35/40%	14/3 lb. va.
Ferro-molybdenum—	
70/75% c. free	5/- lb.
Ferro-titanium—	
23/25% carbonless	11 1/2d.
Ferro-phosphorus, 20/25%,	£17 15 0
Ferro-tungsten—	
80/85%, c. fr.	1/3 lb.
Tungsten metal powder—	
98/99%	1/8 lb.
Ferro-chrome	
2/4% car.	£33 15 0
4/6% car.	£23 15 0
6/8% car.	£23 0 0
8/10% car.	£22 12 6
Ferro-chrome—	
Max. 2% car.	£36 0 0
Max. 1% car.	£42 0 0
Max.0.70% car.	£54 0 0
70%, carbonless	1/4 1/2 lb.
Nickel—99%, cubes or pellets	£170
Ferro-cobalt	9/3 lb.
Aluminium 98/99%	£105
Metallic chromium—	
96/98%	3/- lb.
Ferro-manganese (net)—	
76/80%, loose	£12 0 0
76/80%, packed	£13 0 0
76/80%, export	£11 15 0
Metallic manganese—	
94/96%, carbonless	1/10 lb.
Per ton unless otherwise stated.	

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	s. d. 2 6
Finished bars, 18% tungsten	3 0
Per lb. net, d/d buyers' works.	
Extras—	
Rounds and squares 3 in. and over	4d. lb.
Rounds and squares under 1/4 in. to 1/8 in.	3d. lb.
Do., under 1/8 in. to 1/16 in.	1/- lb.
Flats, 1/8 in. × 1/4 in. to under 1 in. × 3/4 in.	3d. lb.
Do. under 1/8 in. × 1/4 in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.
Bars cut to length 10% extra.	
Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf	1d.
Per lb. net, d/d steel makers' works.	

SCRAP.

	£	s.	d.
South Wales—			
Hvy. steel	3 0 0 to 3	2	6
Bundled steel & shrngs.	2 12 6 to 2	13	6
Mixed iron & steel	2 12 6 to 2	13	6
Heavy cast iron	3 1 0 to 3	2	6
Good machinery for foundries	3 0 0 to 3	2	6
Cleveland—			
Heavy steel	2	15	0
Steel turnings	2	4	6
Cast iron borings	2	2	6
Heavy forge	3	10	0
Bushelled scrap	3	1	0
Cast-iron scrap	3 0 0 to 3	5	0
Lancashire—			
Cast-iron scrap	3	5	0
Hvy. wrought	3	2	6
Steel turnings	2	2	6
London — Merchants' buying prices delivered yard.			
Copper (clean)	48	0	0
Brass (clean)	38	0	0
Lead (less usual draft)	20	10	0
Tea lead	18	10	0
Zinc	18	0	0
New aluminium cuttings	80	0	0
Braziery copper	45	0	0
Gunmetal	48	0	0
Hollow pewter	170	0	0
Shaped black pewter	130	0	0

PIG-IRON

(f.o.t. unless otherwise stated).

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	75/6
Hematite M/Nos.	75/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	88/6
,, d/d Birm.	95/-
Midlands—	
Staffs. common*	—
,, No. 4 forge	—
,, No. 3 fdry.	65/-
Shrops. basic	—
,, Cold blast, ord.*	—
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	—
,, fdry. No. 3	60/-
Derbyshire forge	—
,, fdry. No. 3	65/-
,, basic	—
Scotland—	
Foundry No. 1	—
,, No. 3	75/-
Hem. M/Nos.	77/6
Sheffield (d/d district)—	
Derby forge	69/-
,, fdry. No. 3	71/6
Lincs. forge	—
,, fdry. No. 3	71/6
E.C. hematite	88/6
W.C. hematite	91/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	75/6
Northants foundry No. 3	—
Dalzell, No. 3	105/- to 107/6
Summerlee, No. 3	93/- to 100/-
Glengarnock, No. 3	93/- to 100/-
Gartsherrie, No. 3	93/- to 100/-
Monkland, No. 3	93/- to 100/-
Coltness, No. 3	93/- to 100/-
Shotts, No. 3	93/- to 100/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.	9	15	0 to 11	0	0	
Angles				—		
Tees to 3 united ins.				—		
Nut and bolt iron				—		
Hoops				14	10	0
Marked bars (Staffs.) f.o.t.				13	10	0
Gas strip				12	10	0
Bolts and nuts ½ in. × 4 in.				15	5	0
Steel—						
Ship plates				8	2	6
Boiler plts.				11	0	0
Chequer plts.				10	5	0
Angles				7	12	6
Tees				8	12	6
Joists				7	12	6
Rounds and squares 3 in. to 5½ ins.				7	15	0
Rounds under 3 in. to ⅜ in. (Untested)				8	0	0
				and upwards		
Flats, over 5 in. wide and up				9	2	6
Flats, 5in. to 1½in.				8	2	6
Rails, heavy				8	2	6
Fishplates				12	10	0
Hoops (Staffs.)				10	10	0
Black sheets, 24g.				10	7	6
Galv. cor. shts, 24g.				14	0	0
Galv. fencing wire 8g. plain				12	10	0
Billets, soft 6	0	0	to 7	0	0	
Billets, hard				8	2	6
Sheet bars	5	12	6 to 5	15	0	
Tin bars d/d	5	12	6 to 5	15	0	

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	2½
Sheet to 10 w.g.	1	2¾
Wire	1	3½
Rods	1	2¾
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	20.76
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	17.25
Basic	20.00
Bessemer	20.26
Malleable	19.26
Grey forge	18.76
Ferro-mang. 80% d/d	90.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	33.00
O.-h. billets	33.00
O.-h. sheet bars	34.00
Wire rods	43.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Skelp, sheared steel	1.80
Steel hoops	2.30
Sheets, black, No. 24	3.00
Sheets, galv., No. 24	3.85
Sheets, blue an'l'd, 9 & 10	2.25
Wire nails	2.55
Plain wire	2.40
Barbed wire, galv.	3.25
Tinplate, 100 lb. box	$5.50

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham & North.	
,, foundry	—
,, furnace	15/-
Other Districts, foundry	—
,, ,, furnace (basis)	12/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20 × 14, box	18/4½
,,	28 × 20, ,,	36/6
,,	20 × 10, ,,	—
,,	18¾ × 14, ,,	—
C.W.	20 × 14, ,,	16/9
,,	28 × 20, ,,	—
,,	20 × 10, ,,	—
,,	18¾ × 14, ,,	—

Terneplates 28 × 20, — per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£18/10 to £19/0
Rolled Ord.	£15/0/0 to £15/10
Nail rods	£15 7 6 to £15 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron	£5 15 0 to £6 0 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	*Fittings*
Gas	67½%	45%
Water	63¾%	40%
Steam	60%	35%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.		
Aug. 25	54	10	0	dec.	10/-
,, 26	54	12	6	inc.	2/6
,, 29	55	1	3	inc.	8/9
,, 30	55	3	9	inc.	2/6
,, 31	54	18	9	dec.	5/-

Electrolytic Copper.

	£	s.	d.		
Aug. 25	61	15	0	No change	
,, 26	61	15	0	,,	,,
,, 29	62	0	0	inc.	5/-
,, 30	62	0	0	No change	
,, 31	62	0	0	,,	,,

Standard Tin (Cash).

	£	s.	d.		
Aug. 25	290	0	0	dec.	40/-
,, 26	287	10	0	,,	50/-
,, 29	289	10	0	inc.	40/-
,, 30	289	2	6	dec.	7/6
,, 31	289	10	0	inc.	7/6

Tin (English ingots).

	£	s.	d.		
Aug. 25	288	0	0	dec.	25/-
,, 26	285	10	0	,,	50/-
,, 29	287	10	0	inc.	40/-
,, 30	287	5	0	dec.	5/-
,, 31	287	0	0	,,	5/-

Zinc Sheets (English).

	£	s.	d.		
Aug. 25	36	0	0	No change	
,, 26	36	0	0	,,	,,
,, 29	36	0	0	,,	,,
,, 30	36	0	0	,,	,,
,, 31	36	0	0	,,	,,

Spelter (ordinary).

	£	s.	d.		
Aug. 25	27	12	6	dec.	6/3
,, 26	27	11	3	,,	1/3
,, 29	27	17	6	inc.	6/3
,, 30	27	18	9	,,	1/3
,, 31	27	13	9	dec.	5/-

Lead (English).

	£	s.	d.		
Aug. 25	24	0	0	dec.	5/-
,, 26	23	15	0	,,	5/-
,, 29	24	0	0	inc.	5/-
,, 30	24	0	0	No change	
,, 31	24	0	0	,,	,,

AVERAGE MONTHLY PRICES OF STEEL SHIP ANGLES (NORTH OF ENGLAND).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	4 15 0	4 17 6	5 0 0	5 0 0	5 0 0	4 17 6	4 17 6	4 17 6	4 17 6	5 0 0	5 7 6	5 7 6	4 19 9½
1897	5 7 6	5 7 6	5 7 6	5 5 0	5 0 0	5 0 0	5 2 6	5 2 6	5 2 6	5 2 6	5 0 0	5 5 0	5 3 5½
1898	5 5 0	5 5 0	5 5 0	5 7 6	5 13 9	5 15 0	5 15 0	5 15 0	5 17 6	6 0 0	6 5 0	6 7 6	5 14 3
1899	6 10 0	6 12 6	6 15 0	6 15 0	6 17 6	6 17 6	7 0 0	7 0 0	7 5 0	7 5 0	7 12 6	7 15 0	7 0 5
1900	7 15 0	8 0 0	8 2 6	8 5 0	8 5 0	8 7 6	8 7 6	8 2 6	8 2 6	8 0 0	7 10 0	7 10 0	8 0 7½
1901	6 15 0	6 12 6	6 5 0	6 0 0	6 0 0	5 10 0	5 15 0	5 17 6	6 0 0	5 17 6	5 17 6	5 15 0	6 0 5
1902	5 12 6	5 10 0	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 7 6	5 11 8
1903	5 6 3	5 6 3	5 7 6	5 12 6	5 12 6	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 0 0	5 8 9
1904	5 0 0	4 17 6	5 2 6	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 0 0	5 0 0	5 0 0	5 5 0	5 2 6
1905	5 5 0	5 7 6	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 12 6	6 2 6	6 12 6	6 12 6	5 14 4½
1906	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	7 2 6	6 13 4
1907	6 17 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	6 12 6	6 12 6	7 0 5
1908	6 2 6	6 2 6	6 2 6	5 17 6	5 17 6	5 17 6	5 17 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 16 3
1909	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 7 6	5 7 6	5 7 6	5 7 6	5 7 6	5 7 6	5 7 6	5 9 7
1910	5 16 3	5 17 6	5 17 6	6 1 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 7 6	6 7 6	6 7 6	6 2 3½
1911	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 7 6	6 9 0	6 7 8½
1912	6 16 3	6 17 6	6 17 6	7 5 0	7 7 6	7 7 6	7 7 6	7 12 6	7 12 6	7 12 6	7 14 6	7 17 6	7 7 4½
1913	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 17 6	7 11 6	7 7 6	6 15 6	6 7 6	6 2 6	7 8 11½
1914	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	5 15 0	5 15 0	6 15 0	7 0 0	7 0 0	7 1 3	7 5 0	6 8 7½
1915	7 17 0	8 5 0	8 17 6	9 5 0	9 5 0	9 15 0	9 15 0	9 15 0	9 15 0	9 15 0	10 15 0	10 15 0	9 8 3½
1916	11 3 1½	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6
1917	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6
1918	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6	11 2 6½
1919	11 2 6	13 12 6	13 12 6	13 12 6	17 2 6	17 1 3	17 0 0	17 15 0	17 15 0	17 15 0	17 17 6	18 5 0	16 1 9
1920	19 10 0	20 0 0	21 10 0	22 0 0	23 5 0	24 0 0	24 0 0	24 0 0	24 15 0	24 10 0	24 0 0	24 0 0	22 19 2
1921	22 10 0	20 12 6	19 0 0	17 10 0	17 10 0	16 6 0	14 10 0	14 3 4	13 10 0	11 15 0	10 0 0	9 12 6	15 11 7
1922	9 17 6	10 0 0	10 0 0	10 0 0	10 0 0	9 17 6	9 10 0	8 15 7½	8 14 0	8 12 6	8 12 6	8 12 6	9 7 8½
1923	8 18 1½	9 1 3	9 14 0	10 0 0	10 0 0	10 0 0	9 8 9	9 9 6	9 10 0	9 8 9	9 11 6	9 18 9	9 11 8½
1924	10 0 0	9 18 1½	9 17 6	9 17 6	9 17 2	9 11 3	9 15 0	9 15 0	9 9 4½	9 6 6	9 5 0	9 5 0	9 13 1½
1925	9 2 0	9 0 11½	9 0 0	8 15 9	8 10 3½	8 9 0½	8 6 3	8 2 6	7 19 0½	7 12 3	7 5 0	7 2 6	8 5 5½
1926	7 2 6	7 2 6	7 2 6	7 3 4	7 2 6	7 3 9	7 7 6	7 8 5½	7 9 0	7 12 6	7 16 3	8 0 6	7 7 7½
1927	7 18 9	7 17 6	7 17 6	7 14 8½	7 13 9	7 12 6	7 12 6	7 12 6	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
ROYAL BLDS., FISHER ST., SWANSEA.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
20, SECOND LINE BEACH, MADRAS.
1, HONG KONG ROAD, SHANGHAI.

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